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CONTENTS

The Occurrence of Puccinia graminis tritici-compacti in the Southern States. E. C. Stakman and G. R. [illegible]

Determination of the Factors Inducing Leaf Roll of Potatoes Particularly in Northern Climates. First Progress Report. Paul A. Murphy and E. J. [illegible]

Pathological Aspects of the Federal Fruit and Vegetable Inspection Service. C. L. [illegible]

Briefer Articles:

Perennial Mycelium of Gymnosporangium Blasdaleanum. J. S. [illegible]

Cultures of Ascidium tuberculosum and A. pentaphyllinum. H. E. [illegible]

Some New or Little Known Hosts for Wood-Destroying Fungi. II. Arthur S. [illegible]

Reviews

Phytopathological Notes

Literature on Plant Diseases

Report of the Ninth Annual Meeting of the American Phytopathological Society

Appendix

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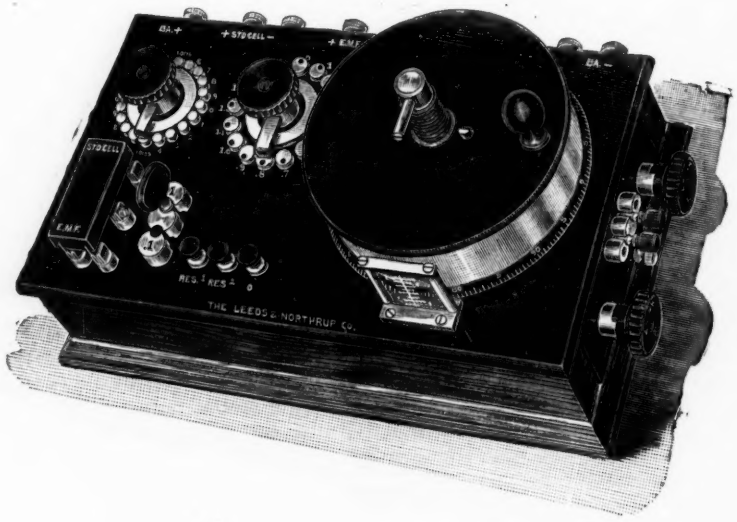

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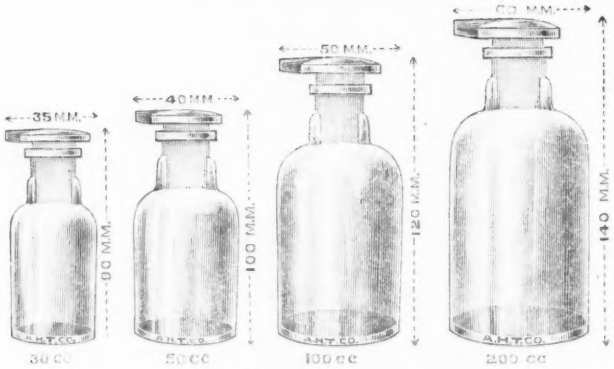

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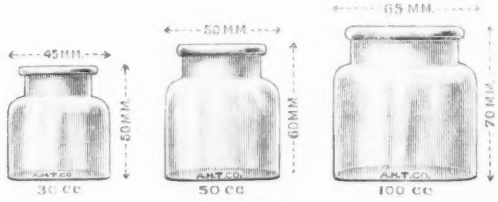

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PHYTOPATHOLOGY

VOLUME VIII NUMBER 4

APRIL, 1918

THE OCCURRENCE OF PUCCINIA GRAMINIS TRITICI-COMPACTI IN THE SOUTHERN UNITED STATES[1]

E. C. Stakman and G. R. Hoerner

A strain of *Puccinia graminis* Pers. found in the fall of 1916 on club wheat and grasses in the Palouse district of the Pacific Northwest was described by Stakman and Piemeisel[2,3] as a new biologic form under the name *Puccinia graminis tritici-compacti*. Although extensive observations had been made in the upper Mississippi Valley and northern Great Plains area, the new form was not found east of the Continental Divide.

In May, 1917, however, *P. graminis tritici-compacti* was found also in the south. It was first collected on heavily rusted wheat at Baton Rouge, La.[4] Inoculations were made on Haynes bluestem, Minn. 169, a hard wheat of the *vulgare* group on which the behavior of the rust was strikingly similar to that of the *tritici-compacti* strain collected in 1916 in Washington state. More material was obtained from both barley and wheat grown near Baton Rouge, La., and Stoner and "Golden Chaff"

[1] Cooperative investigations between the Agricultural Experiment Station of the University of Minnesota and the Bureau of Plant Industry of the United States Department of Agriculture.

Published with the approval of the Director as Paper No. 99, of the Journal Series of the Minnesota Agricultural Experiment Station.

[2] Stakman, E. C. and Piemeisel, F. J.—A new strain of *Puccinia graminis*. Phytopath. **7**: 73. 1917.

[3] Stakman, E. C. and Piemeisel, F. J.—Biologic Forms of *Puccinis graminis* on Cereals and Grasses. Jour. Agr. Research **10**: 468–470. 1917.

[4] The writers are indebted to Dr. C. W. Edgerton, Plant Pathologist, University of Louisiana, for help in securing material for the first set of inoculations; to Dr. G. L. Peltier, Plant Pathologist, Alabama Polytechnic Institute, for sending material from Alabama; to Dr. C. W. Hungerford, Scientific Assistant, Office of Cereal Investigations, Bureau of Plant Industry, U. S. Department of Agriculture, for material from Oregon; and to F. J. Piemeisel formerly Scientific Assistant, Office of Cereal Investigations, Bureau of Plant Industry, U. S. Department of Agriculture, for material collected at various places.

wheat grown near Brundidge, Alabama. Material was obtained later from Beaumont, Texas. All the rust on wheat and barley from these localities developed very weakly on hard spring wheats of the *vulgare* group, but developed normally on Club wheat from Washington (see fig. 1).

COMPARISON OF THE PARASITISM OF WESTERN AND SOUTHERN STRAINS.

The behavior of the southern strain of rust was therefore tested thoroughly in comparison with that of the western strain. None of the western strain was in the greenhouse at the time, so accidental infection was not possible. The photographs and notes made of the western form in the winter of 1916 and 1917 were used for comparison with the southern form until recently when a strain of *P. graminis tritici-compacti* from Corvallis, Oregon, was used as a check. The results of inoculations on grasses and cereals with two strains of the *tritici-compacti* form and one strain of the *tritici* form are given in table 1.

In table 1 the varieties inoculated are grouped under the names of the various so-called species of *Triticum* to which they belong. The numbers, unless otherwise specified, are those of the Office of Cereal Investigation, U. S. Department of Agriculture. The result is given in the form of a fraction, the denominator indicating the total number of leaves inoculated and the numerator the number which developed uredinia. The number after the semicolon indicates the number of leaves which became flecked but did not produce uredinia. The western strains used were isolated in the fall of 1916 from club wheat and *Elymus glaucus* from Eastern Washington; the southern strain from varieties of common wheat from Brundidge, Alabama, and the ordinary *tritici* strain was isolated in 1914 from *Hordeum jubatum* and kept on various hosts in the greenhouse since that time.

The methods used were similar to those described by Stakman and Piemeisel.[5]

The results of inoculations with the rust from the south show clearly that it is identical parasitically with *P. graminis tritici-compacti* from the west. Not only do the rusts from both sections of the country act alike on the varieties of wheat and other cereals inoculated, but the following grasses can be infected in equal degree by both: *Agropyron tenerum* Vasey, *A. smithii* Rydb., *Bromus tectorum* L., *Elymus canadensis* L., and *Hordeum jubatum* L. In addition to these the following have been suc-

[5] Stakman, E. C. and Piemeisel, F. J.—Biologic Forms of *Puccinia graminis* on Cereals and Grasses. Jour. Agr. Research **10**: 431. 1917.

TABLE 1

Results of inoculations with Puccinia graminis tritici-compacti and P. graminis tritici on varieties of wheat

PLANT INOCULATED	*P. graminis tritici-compacti* SOUTHERN STRAIN		*P. graminis tritici-compacti* WESTERN STRAIN		*Puccinia graminis tritici*	
	Result	Character of infection	Result	Character of infection	Result	Character of infection
Triticum compactum Club wheat	181/229	Very heavy	464/486	Very heavy	13/13	Very heavy
Triticum durum Arnautka 1493	0/5;5	Hypersensitive; distinct white dead areas			7/8	Quite susceptible; large uredinia
Iumillo 1736	7/7	Small uredinia; slightly hypersensitive	48/59	Variable; uredinia mostly small. Little hypersensitiveness	15/18	Small uredinia. Fairly normal infection
Kubanka 2094	6/6	Many small uredinia. Hypersensitiveness not sharp. Infected areas yellow	46/52	Variable; uredinia small in moderately sharp dead areas; few large and vigorous	4/18	Moderately resistant; uredinia variable—mostly small; few strong flecks
Kubanka 4063		Small uredinia; hypersensitive	59/61	Variable; uredinia large or small; dead areas not large	3/3	Quite susceptible; large uredinia
Triticum dicoccum Emmer 1522	5/9	Minute uredinia; small dead areas	20/22	Small uredinia; dead areas sharp		
Emmer 1524	6/13	Moderately hypersensitive; fair sized uredinia; surrounding areas yellow	52/60	Variable; moderately hypersensitive; fairly large uredinia	8/14;5	Same as for western strain
Emmer 1526	7/8	Minute uredinia; very small, sharp dead areas	11/23	Small uredinia; sharply hypersensitive		
Khapli 4013	3/5;1	Minute uredinia; flecks very sharp but small			3/4	Highly resistant; very small uredinia; sharp flecks.
Wild emmer 3109	6/7	Moderately hypersensitive; small uredinia				
Triticum monococcum Einkorn 2433	7/8	Heavy	39/47		2/6	Resistant; small uredinia; sharp flecks
Triticum spelta Spelt 4775	5/7;2	Small uredinia; hypersensitive			6/16	Highly resistant; sharp, pale or white areas; small uredinia

TABLE 1—*Continued*

PLANT INOCULATED	*P. graminis tritici compacti* SOUTHERN STRAIN		*P. graminis tritici compacti* WESTERN STRAIN		*Puccinia graminis tritici*	
	Result	Character of infection	Result	Character of infection	Result	Character of infection
Triticum turgidum Poulard 4951	5/8	Moderate			6/7	Quite susceptible; large uredinia
Triticum vulgare Turkey (Alberta Red) Minn. 1483	12/12	Moderate; uredinia medium in size	19/21	Few small uredinia; dead areas neither sharp nor large		
Haynes bluestem Minn. 169	75/184;11	Small uredinia; sharply hypersensitive	430/494	Small uredinia; sharply hypersensitive	X	Very heavy
Turkey (Cosgrove) Minn. 1487	11/11	Numerous small uredinia; slightly hypersensitive. Resistant	12/13	Variable; moderately resistant; uredinia small; hypersensitiveness slight		
Dicklow 3663	6/6	Heavy	11/14	Very heavy		
Marquis 3641	6/11	Uredinia small; flecks small, sharp; distinctly hypersensitive	31/31	Uredinia very small; very sharply hypersensitive; fair infection	72/79	Heavy
Turkey (N. K. & Co.) Minn. 1488	8/10	Moderate infection; numerous, small uredinia; slightly hypersensitive	14/17	Resistant; uredinia small; sharp dead areas; some green islands		
Turkey Minn. 323	5/7	Fairly vigorous uredinia; but infected areas sharp and whitened	16/17	Moderate; infected areas sharp, whitened		
Turkey Minn. 829	10/10	Moderate; numerous small uredinia; slightly hypersensitive	16/18	Subnormal; small uredinia; sharp dead areas		
Pacific bluestem 4067	7/7	Heavy	15/19	Very heavy		
Hybrids Kubanka × Preston 2094 3081	6/7	Uredinia small; small hypersensitive areas			8/8	Entirely susceptible
Kubanka × Haynes 2094 bluestem Minn. 169	2/6;3	Extremely minute uredinia; hypersensitiveness sharp			13/13	Quite susceptible; large uredinia
Iumillo × Preston 1736 Minn. 188	3/6	Uredinia small			11/12	Susceptible; very large uredinia

cessfully infected with the southern strain but have not been inoculated with the western strain: *Agropyron caninum* (L.) Beauv., *Bromus japonicus* Thunb., *Elymus virginicus* L., *Hordeum pusillum* Nutt.

Neither strain infected any of the following: *Agrostis alba* L., *Agrostis stolonifera* Vasey, *Anthoxanthum odoratum* L., *Phleum pratense* L., *Poa compressa* L.

THE REACTION OF WHEATS TO THE RUST

The behavior of different varieties of *Triticum vulgare* to the rust is worthy of notice. Practically all degrees of resistance are shown. Early

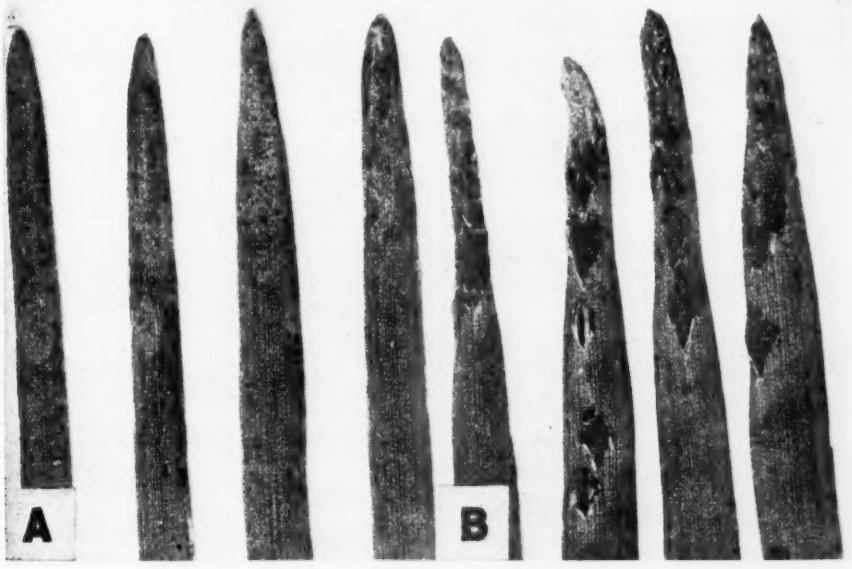

FIG. 1. *Puccinia graminis tritici-compacti* from Brundidge, Ala., on (*a*) common wheat, Haynes bluestem, Minn. 169. (*b*) club wheat.

Baart, Pacific bluestem and Dicklow are completely susceptible (see fig. 2 b), the rust developing as well on these varieties as it does on club wheat from Washington. Considerable variation occurs within the Crimean (Turkey) group of wheats (see fig. 2 a). Some are very resistant, while others are fairly susceptible. For instance, on Alberta Red, Minn. 1483, the uredinia are small but there is little hypersensitiveness, while Turkey, Minn. 829, is very hypersensitive—the dead areas being almost as sharp as those on Glyndon fife, Minn. 163, or Haynes bluestem, Minn. 169. The cause for the peculiar and distinctive reaction of different varieties to the *tritici-compacti* strain should be an intensely interesting

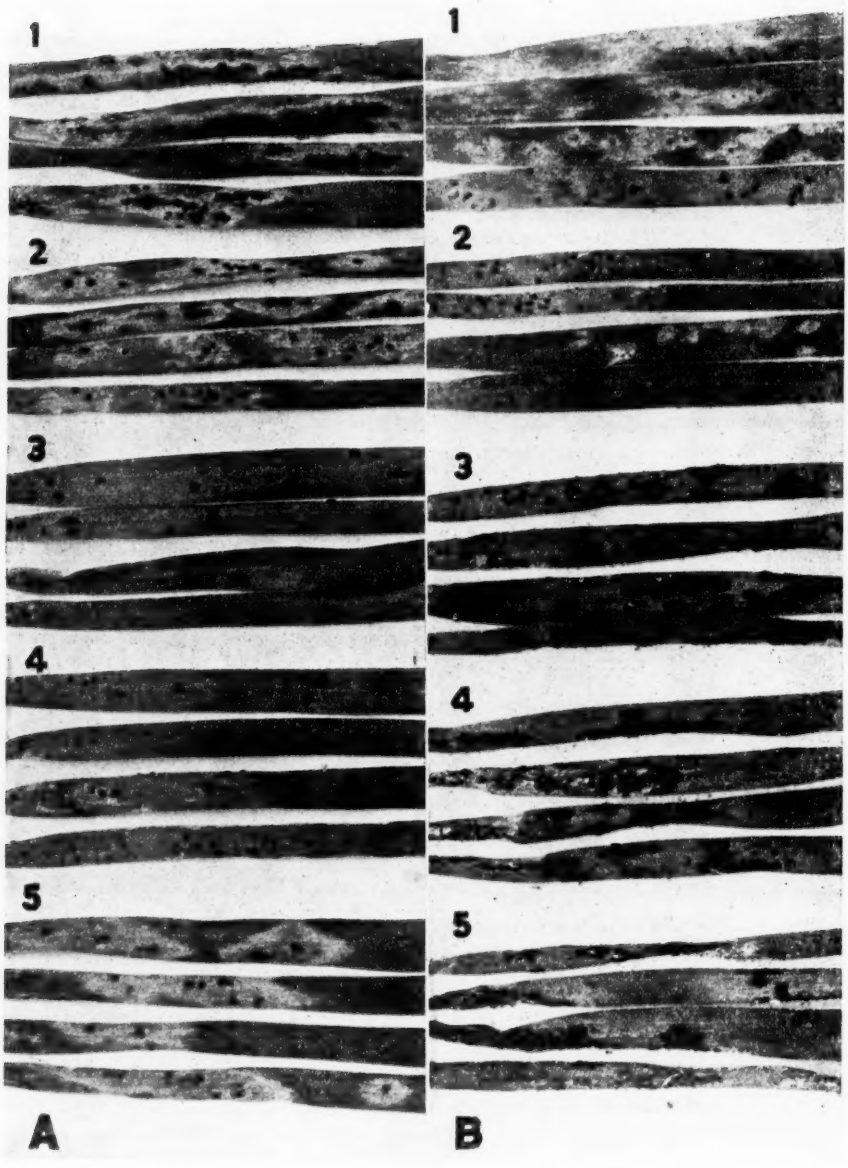

FIG. 2. (a) *Puccinia graminis tritici-compacti* from *Elymus glaucus* collected at Ellensburg, Washington, on (1) Turkey, Minn. 323, (2) Turkey, Minn. 829, (3) Turkey (Alberta Red) Minn. 1483, (4) Turkey (Cosgrove) Minn. 1487, (5) Turkey (from Northrup King & Co.) Minn. 1488.

(b) *Puccinia graminis tritici-compacti* from *Elymus glaucus* collected at Ellensburg, Washington, on (1) emmer 1522, (2) emmer 1526, (3) Early Baart 1697, (4) Pacific bluestem 4067, (5) Dicklow 3663.

object of investigation. There seems to be some correlation between the hardness of the common wheats and resistance; the degree of resistance, at least in some cases, is apparently directly proportional to the hardness of the wheat. Whether this will prove to be generally true remains to be determined; work is under way. If it does prove to be true, it may be possible to ascertain more exactly the actual cause for the resistance. However, the apparent correlation may be coincidence only.

The hybrids inoculated were pure line selections made in the Minnesota rust nursery in 1911. All three were more or less intermediate, the head characters resembling quite closely those of the common wheat parent, while the kernels were intermediate. The reaction to rust in all cases was more like that of the common wheat parent than of the durum parent; all three were susceptible to *P. graminis tritici* and highly resistant to *P. graminis tritici-compacti*.

The work with Einkorn and some of the durums is not conclusive, while the emmers, spelt and poulard wheats inoculated seem to react quite similarly to both rust forms.

PARASITIC AND MORPHOLOGIC CONSTANCY

On the basis of parasitism it is quite clear that *P. graminis tritici-compacti* is a definite biologic form—not merely a local variation of *P. graminis tritici*. The rust acts the same whether taken from club wheats or grasses in the Pacific Northwest or from soft wheats of the *vulgare* group from the Southern or Southeastern United States. Inoculations made with urediniospores developed on Stoner, and other varieties of common wheats in Alabama gave precisely the same results as those made with urediniospores developed on club wheat in the Palouse district of Washington. Nor did the rust from either region change after having been cultured in the greenhouse on various hosts for about six months.

The morphology of the urediniospores is also surprisingly uniform. Some urediniospores of the strain originally isolated from wheat grown in Alabama and then grown on barley two generations, Haynes bluestem, Minn. 169, one generation, then on club wheat four generations, were given Mr. M. N. Levine, who has made an extensive study of the morphology of urediniospores of biologic forms of *Puccinia graminis*, with the request that he determine, if possible, the identity of the rust. After measuring 100 spores he unhesitatingly pronounced it *P. graminis tritici-compacti*, although he did not know that any of this form was being grown in the greenhouse at the time. The uniformity in the size of the urediniospores is shown clearly in table 2. On the very resistant Haynes

bluestem the spores became appreciably smaller. This is usually true of most forms developed on uncongenial hosts.

TABLE 2

Comparative dimensions of urediniospores of P. graminis tritici-compacti from different localities

SOURCE OF RUST	PLANT INOCULATED	UREDINIOSPORE DIMENSIONS IN MICRONS	
		Size limits	Modes
Ritzville, Wash.	Triticum compactum*	24.96–37.76 x 16.64–22.72	31.68 x 19.84
Pullman, Wash.	Triticum compactum	25.28–37.76 x 14.40–25.28	31.68 x 19.52
Baton Rouge, La.	Triticum compactum	24.96–37.76 x 15.68–23.36	31.68 x 19.52
Brundidge, Ala.	Triticum compactum	24.00–38.72 x 16.64–22.40	31.36 x 19.52
Pullman, Wash.	Triticum vulgare†	22.40–33.92 x 16.00–23.36	28.16 x 19.52
Brundidge, Ala.	Triticum vulgare	21.44–33.92 x 16.96–22.72	28.16 x 19.52

* Club wheat from Washington.

† Haynes bluestem, Minn. 169.

GEOGRAPHIC DISTRIBUTION

The geographic distribution of the rust is still imperfectly known. It certainly occurs in the Palouse district of the Pacific northwest and in Oregon. East of the Rocky Mountains it has been found up to the present in Alabama, Louisiana and southeastern Texas, but it undoubtedly is more widespread. It is improbable that it occurs very far north except in the Pacific northwest; inoculations made with stem rust on wheat from Kansas, Oklahoma, southern Illinois and Kentucky indicate that the ordinary *tritici* form is at least more common in those regions, and it is doubtful whether the *tritici-compacti* form occurs there at all. A few inoculations made with a form found on volunteer barley in southern Virginia indicate that the *tritici-compacti* form may occur there.

The factors limiting the distribution of the rust and its possible importance in rust epiphytology are not known. It is possible that it is common only where soft wheats are grown, or where climatic factors may determine its geographic limits. If it proves to be widespread in the south it certainly renders less probable the hypothesis, held by many, of the seasonal spread of wheat stem-rust from south to north. It may also explain the fact that varieties of wheat show varying resistance in different regions. The whole question of the degree of constancy in the relations between the rust and its host plants is being investigated in connection with the rust epiphytology studies now being made by the Office of Cereal Investigations, Bureau of Plant Industry, United States Department of Agriculture.

SUMMARY

1. *Puccinia graminis tritici-compacti* Stak. and Piem. has been found on wheat in the south in southeastern Texas, in Louisiana and in Alabama.

2. Parasitically and morphologically this strain of rust on common wheat in the south is practically identical with that on club wheat and wild grasses in the Pacific northwest.

3. The fact that the rust is so constant on different hosts and in widely separated localities indicates very strongly that it is not merely a local variant form of *P. graminis tritici*.

4. A number of club wheats and some soft wheats of the *vulgare* group are congenial hosts for *P. graminis tritici-compacti*, indicating a possible correlation between softness and susceptibility. This may be merely coincidence, however.

5. The geographic limits of the form *tritici-compacti* are imperfectly known. It has been found in the south and in the Pacific northwest. It may be much more widespread, but probably does not occur in the upper Mississippi Valley and northern Great Plains.

6. The fact that the hard spring wheats commonly grown in the spring wheat region are highly resistant to the biologic form of stem-rust most commonly found on wheat in the south renders less probable the theory of the seasonal spread of rust from south to north in successive waves.

7. Further investigations are under way.

DETERMINATION OF THE FACTORS INDUCING LEAF ROLL OF POTATOES PARTICULARLY IN NORTHERN CLIMATES. FIRST PROGRESS REPORT.

PAUL A. MURPHY AND E. J. WORTLEY

Following the work of Quanjer[1] in Holland published in 1916, in which was announced the transmission of leaf roll to healthy potato plants grown in proximity to diseased ones, it has been found that this also has taken place in the plots of the first-named author in Prince Edward Island in every case in which the product of healthy plants which grew beside diseased hills in 1916 was used for "seed" in 1917. There were three separate lots of potatoes of this kind, all previously healthy, and they developed leaf roll to the extent of 89.5 per cent, 50 per cent and 19.4 per cent respectively.

The conditions under which these results were obtained were very favorable for the purpose in view. Leaf roll does not naturally arise *de novo* in the district. In fact, native stock in Prince Edward Island may be said to be free from the disease for all practical purposes.

The first lot of potatoes in which the transfer took place was of the variety Garnet Chili and was originally derived from Mr. A. E. Logan, Lower Truro, N. S., being imported to Charlottetown, P. E. I., in the autumn of 1915. Previous to that time it had been inspected by one or both of the authors on the farm of the original owner for two years and had been passed as commercially, if not absolutely, free from the disease in question. Its record is therefore now known for four years. It was used for "seed" in three experiments in the plant disease plots at the Experimental Station in Charlottetown in 1916, as shown in diagram I, *A*, *B* and *C*. Plants diseased with leaf roll (all of the variety Garnet Chili) are shown in the diagram as solid black circles; healthy plants of the same variety are shown as circles with continuous outlines; while healthy plants of other varieties appear as circles with dotted outlines.

The history of block *C* of Logan's stock is given in another part of this paper. Row *A* of this stock was, as will be seen, among rows of plants more or less diseased with leaf roll, and the block marked *B* was removed from the nearest leaf roll plants by the width of eight rows. The soil

[1] Quanjer, H. M. Nature, mode of dissemination and control of phloem-necrosis (leaf roll) and related diseases, i.a. Sereh. Med. van de Rijks Hoogere Land-, Tuin en Boschbouwschool. Deel 10. 1916.

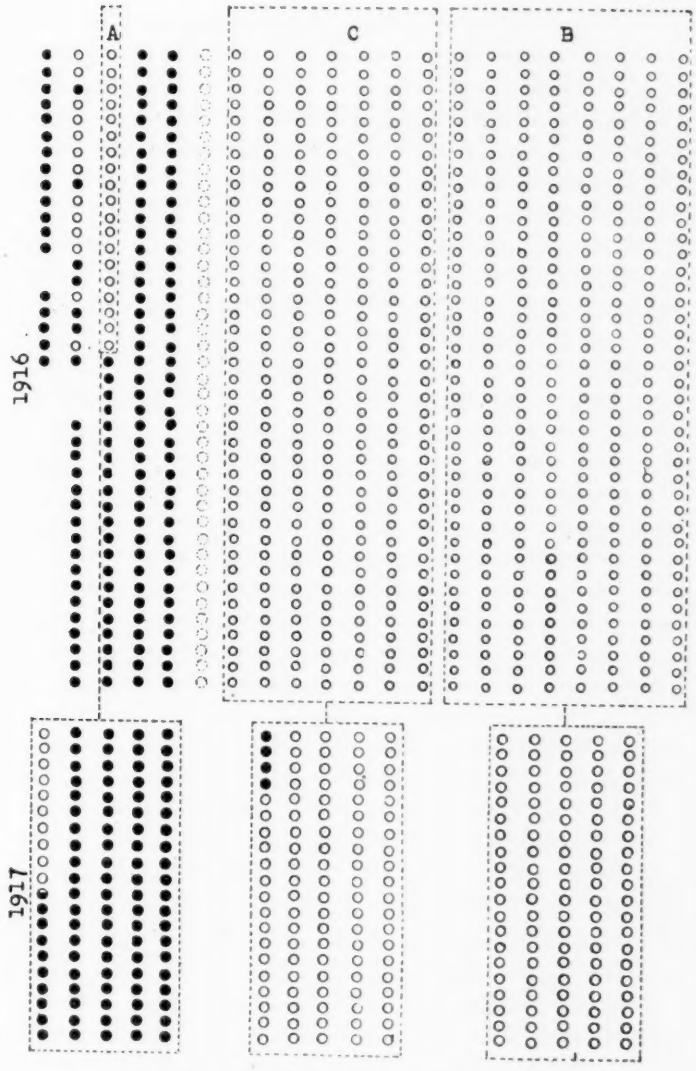

FIG. 1. PLOTS DISEASED WITH LEAF ROLL

Diseased plants, all of the variety Garnet Chili, are represented by solid black circles. Healthy plants of the same variety are represented by circles with continuous outlines. Healthy plants of other varieties are represented by circles with dotted outlines. Blocks A, B and C were planted with the same stock in 1916, namely Mr. A. E. Logan's Garnet Chili. The result of planting tubers from these three blocks in 1917 is shown in the lower part of the diagram. The actual number of plants grown in 1917 is not shown but the diagram represents accurately the percentages of leaf roll which developed.

in this plot was uniform throughout and both lots were planted at the same time, had the same general treatment during the season, and were harvested at the same time. Potatoes had been grown there the previous year, but the crop was inspected and was free from leaf roll. Prior to that time it had been under buckwheat and strawberries and had not grown a crop of potatoes for at least five years.

The nineteen plants which grew in row *A* were each preserved separately in cotton bags. Owing to limitations of space it was possible to plant only one tuber from each bag in 1917. They were planted in good soil, and nine rows intervened between them on one side and the nearest block of leaf roll plants, and two rows on the other side. The nineteen sets grew and produced seventeen plants obviously diseased with leaf roll and two healthy plants, or a crop 89.5 per cent diseased.

"Seed" taken at random from block *B* of 1916 planted in an adjacent plot produced an entirely healthy crop of 96 plants. The treatment of both lots was essentially the same throughout the season and the soil on which they were planted was uniform. There is no factor known to the authors which would account for the different behaviour of the two lots except that the *A* "seed" was grown in close proximity to leaf roll plants while the *B* "seed" was not.

Confirmation of this assumption was obtained in rather a striking way. A strain of potatoes belonging to the Green Mountain group had been grown in the disease plots at Charlottetown for two years prior to 1917. It had been under close observation during that time owing to the fact that it was affected with mosaic and was being used as material for the study of that disease. It never showed any trace of leaf roll until 1917, when fifteen out of thirty plants grown developed severe symptoms of the disease. The affair seemed inexplicable until it occurred to us to turn up the field plan of the previous year when we found that the stock had been growing beside a row of leaf roll plants.

Exactly the same experience was had with an unknown variety, probably Burbank's Seedling, which was being studied for wilt during the seasons of 1915 and 1916, at which time it showed no symptoms of leaf roll whatever. Seven out of thirty-six plants (19.4 per cent) of this strain developed leaf roll in 1917, and here again the only reason that can be assigned is the fact that we found it also had been grown in 1916 beside leaf roll plants.

The three lots mentioned are the only ones of those which had been grown in close proximity to the disease which were preserved for planting, and, as has been shown, they all reacted in the same way although the amounts of disease which developed were different. Furthermore, leaving out of account those stocks which were affected to some extent

with the disease, in which according to our experience almost any plant may develop leaf roll in subsequent years, these three stocks were, with two exceptions, the only ones in which leaf roll developed in our plots at Charlottetown from "seed" from apparently healthy plants. The first of these two exceptions was another block of Logan's Garnet Chili stock (marked *C* in the diagram), "seed" which had fifteen leaf roll plants in 392, or 3.8 per cent in 1917. While this at first sight may seem to detract from the cogency of the arguments just advanced, there are two good reasons for believing that the appearance of leaf roll here is to be explained by the same hypothesis. It will be noted that only one row intervened between this block and diseased plants in 1916, and it is reasonable to assume, accepting the work of Quanjer[2] which our own results go so far to verify, that infection was conveyed to the outside plants of the block across the intervening row, since that author finds that infection may be carried to metres and our rows were only 30 inches wide. In the second place, if the infection took place through the outside row it is reasonable to assume that the tubers would not be sufficiently mixed to infect the crop uniformly, particularly as they were not all stored together but were kept in several 90-pound bags. This in fact was what happened. One of the seven rows planted had six diseased plants in fifty-two, or 11 per cent, while another had none.

The other exception mentioned concerned one single plant grown from "seed" from an apparently healthy hill which developed leaf roll in 1917. Examination of this case showed that the plant from which it was derived in 1916 was separated by the width of one row, or 30 inches, from diseased plants.

The hills which apparently contracted the infection in 1916 showed no trace of the fact during that year and they were particularly examined on that point, at least in the case of Logan's stock in block *A*. They appeared perfectly healthy all during the season and there was never any appearance at all resembling the so-called primary stage described and illustrated by Quanjer.[3] So far as we know the question of possible soil infection did not enter into the experiment. The accident that certain of the plants were affected with wilt before contracting leaf roll is to be taken as such.

The importance of this factor in inducing and disseminating leaf roll is considerable, and it helps to explain some facts hitherto not understood. Under conditions such as those at Charlottetown, where there is good reason for believing that the disease never arises of itself, one would expect it to disappear in the course of time after it has been imported through the agency of infected "seed" owing to the very low

[2] L. c.
[3] L. c.

yield of diseased plants. This does not occur however. We find leaf roll still present in stocks imported in the years 1910 to 1913 and the amount of disease is increasing instead of decreasing. There is evidence indeed that it has spread to varieties presumably originally healthy because the stock from which they were derived is still healthy. The probable manner in which the spread took place is discussed in a later paragraph.

The fact, which is now being generally recognised, that it is impossible to rid a stock of leaf roll by the selection of healthy hills, even when there is only a moderate amount of the disease present and the work is carried out under conditions unfavourable to the production of the disease, is readily explained by this hypothesis. Assuming the minimum spread given by Quanjer,[1] namely 1 meter, there will be ten other plants within the sphere of influence of each diseased hill when the plants are set 15 inches apart in 30 inch rows. If Quanjer's maximum (2 meters) be taken the number is increased to the enormous total of forty-two. The far-reaching character of this discovery will be more fully realized when it is remembered that so far as our experience has gone the infection remains latent until the following year.

There is another point of considerable although of less general importance. In cases in which large collections of varieties are maintained they are usually grown in long rows side by side. We have come across cases leaving little room for doubt that whole collections have been seriously contaminated by the spread of the disease from certain infected rows. This seems to have happened in the Charlottetown variety plots. The twenty-three varieties grown there now average eight per cent of leaf roll, last year they averaged five per cent, and, as has been stated, there is good ground for believing that some of the sorts now affected were originally free from the disease. On the other hand the field crops of potatoes at Charlottetown are commercially free from the disease, as may be seen from the fact that one leaf roll plant was found in one acre in 1916. The difference seems to us only attributable to the fact that some of the potatoes in the variety plots are known to have been diseased at the beginning and that they contaminated the remainder of the collection, while the stock used on the rest of the farm was not exposed to infection.

It would be a wise precaution in the case of collections of varieties to separate the rows from one another by a distance of at least 6 feet and to plant the intervening space with some other hoed crop. To economise space the varieties might be planted in compact blocks of several short rows, the blocks being separated at least 6 feet each way from one another. When new "seed" is introduced it would be safer to grow it for the first year in quarantine removed as far as possible from all other potatoes so as not to endanger the health of the remainder of the stock.

PATHOLOGICAL ASPECTS OF THE FEDERAL FRUIT AND VEGETABLE INSPECTION SERVICE[1]

C. L. Shear

Although plant pathologists may not be able to offer any quick and easy solution of the food problem in the present crisis, yet we believe there is an opportunity for us to perform very important and valuable service in preventing more effectively the great losses of plant food due to disease and decay. I am sure we are not only willing, but anxious to improve every opportunity of this kind to the fullest extent. To do this most quickly and effectively it is necessary to determine carefully the relative value and importance of the various opportunities offered for immediate practical work in this field and then direct our resources and energies accordingly. In order to accomplish most there should be the fullest cooperation on the part of all the agencies which can assist in this work.

Heretofore pathologists have devoted most of their attention to laboratory and field investigations. We have only lately begun to appreciate the fact that many of our field troubles do not end in the field and that frequently new ones develop during the shipping and marketing of crops. Therefore, in order to protect and conserve perishable crops to the fullest extent they must be studied in transit and distribution, and a thorough knowledge obtained of the rots and other forms of spoilage which so frequently occur after the product has left the grower. Studies of this kind will also throw light upon the pathological problems involved in the field and laboratory and make it possible to devise more efficient and effective means of preventing losses.

In this connection we should like to call attention to some of the pathological problems and the possibilities of service offered by and in connection with the recently established Food Inspection Service of the Bureau of Markets of the United States Department of Agriculture. To make clear the scope and purposes of the Act establishing this service, we may quote from the Food Products Inspection Law of August 10, 1917 (5), entitled "An Act to provide further for the national security and defense by stimulating agriculture and facilitating the distribution of agricultural products."

Section 8 of this Act provides "for enabling the Secretary of Agricul-

[1] Paper read at the War Service Symposium of the American Phytopathological Society, Ninth Annual Meeting, Pittsburgh, Pa.

ture to investigate and certify to shippers the condition as to soundness of fruits and vegetables and other food products when received at such important central markets as the Secretary of Agriculture may from time to time designate and under such rules and regulations as he may prescribe: *Provided*, That certificates issued by the authorized agents of the department shall be received in all courts as prima facie evidence of the truth of the statements therein contained."

Under this authority the Secretary of Agriculture has issued rules and regulations to be followed in carrying out the provisions of the law. These rules and regulations are found in Circular Number 82 of the Office of the Secretary, U. S. Department of Agriculture, October 31, 1917. These regulations provide for establishing food products inspection service in twenty-six of the larger cities of the United States as follows:

Atlanta, Georgia	Memphis, Tennessee
Baltimore, Maryland	Minneapolis, Minnesota
Birmingham, Alabama	Mobile, Alabama
Boston, Massachusetts	Montgomery, Alabama
Chicago, Illinois	New Orleans, Louisiana
Cincinnati, Ohio	New York, New York
Dallas, Texas	Jersey City, New Jersey
Fort Worth, Texas	Philadelphia, Pennsylvania
Galveston, Texas	Pittsburgh, Pennsylvania
Houston, Texas	Providence, Rhode Island
Indianapolis, Indiana	St. Louis, Missouri
Jacksonville, Florida	St. Paul, Minnesota
Kansas City, Missouri	Washington, District of Columbia

The service is to be extended to the following additional markets as rapidly as competent inspectors can be secured and trained:

Alexandria, Virginia	Los Angeles, California
Buffalo, New York	Milwaukee, Wisconsin
Cleveland, Ohio	Newark, New Jersey
Council Bluffs, Iowa	Oklahoma City, Oklahoma
Des Moines, Iowa	Omaha, Nebraska
East St. Louis, Illinois	Portland, Oregon
Denver, Colorado	Sacramento, California
Detroit, Michigan	San Francisco, California
Kansas City, Kansas	Seattle, Washington
Lincoln, Nebraska	Wichita, Kansas

For the present raw fruits and vegetables only are to be inspected, but other food products will be designated later. According to these regulations any shipper of such food products, or any person so authorized by him, may make application for inspection, such application to be filed in the office of the food products inspection serving the market at which the

shipment has been or is to be received. Such application may be in writing, by telegram or orally. Other minor details in regard to necessary data to be furnished are provided for.

Any food products inspector may also of his own motion, when authorized by the Chief of the Bureau of Markets, investigate the condition as to soundness of any food products received at a market designated.

No inspection certificate shall be issued for any food product unless the inspection was made under such conditions as permitted a determination of the true conditions as to soundness of the entire lot.

It will be noted that authority under this act is restricted to investigating and certifying the conditions as to *soundness* of fruits, vegetables and other food products. This, of course, necessarily involves a knowledge of all the various causes which may produce unsoundness of such products. In this connection the Chief of the Bureau of Markets has requested the coöperation of the pathological offices of the Bureau of Plant Industry in carrying on this work.

This inspection service was begun November 1, 1917, in New York and Chicago. It is being extended as rapidly as practicable to all of the other large market centers mentioned.

Few people, even pathologists, realize what enormous quantities of fruits and vegetables are lost through disease, decay, and other preventable causes, between the producer and the consumer. It should also be noted that much of such produce which reaches the consumer is greatly deteriorated or unfit for food. Unfortunately, full and exact data are not available in many cases. Adams (1), in his book on Marketing Perishable Farm Products, asserts that at least 25 per cent of the perishables sent to wholesale markets is hauled to the dump pile. We have also a recent statement on this subject by G. Harold Powell (4), who is widely known and has had much experience in the distribution of fruits. He said, in an address before the International Apple Shippers Association last year, "Frequently one-half or more of a perishable crop is lost by careless handling."

These statements seem almost unbelievable, but they are made by men of reputation and experience. With such conditions obtaining, it is not surprising that the consumer has to pay high prices for such products.

Doctor Pennington (3), of the Bureau of Chemistry, states that in 1910 the New York Board of Health condemned and destroyed over 12,000,000 pounds of fruit and over 7,000,000 pounds of vegetables. This of course, was only a part of the total loss in that city.

Data derived from the railway claim agents may also give some idea of the great losses of such products which occur during transportation alone. According to a report of the American Association of Refrigera-

tion (2), the claims paid by 180 railroads in the United States in 1914 for loss of perishable freight was $4,977,383.09, of which over one-half or $2,687,393.36 was for fruit and vegetables. This does not represent all the railways and presumably not all the claims made against those reporting, as some were probably not paid.

Estimates by southern pathologists and others familiar with the facts indicate that at least 50 per cent of the sweet potato crop is lost after harvesting, chiefly from fungous diseases.

According to conservative estimates by pathologists and growers more than 10 per cent of the total fruit crop of the country is lost from rot and other spoilage after picking. This loss expressed in cash would amount to over $20,000,000 per annum.

There would seem to be no necessity of argument to show the need of preventing so far as possible this enormous loss of food stuffs. It is considered a very serious matter to have growing crops injured or destroyed in the field, but how much more serious it is to have them destroyed after all the additional labor and expense of harvesting, packing and shipping.

The facilities offered in connection with the new inspection service make it possible when utilized to their fullest extent, to very materially reduce these great losses of food products.

The producer or shipper rarely realizes in what condition his products frequently reach the market and why he sometimes gets little or no returns for them. He frequently does not have confidence in the dealer who handles them, and he naturally suspects that the report of their condition which he receives is exaggerated at least, and this suspicion is unfortunately based in some instances upon rather unpleasant experiences with dishonest dealers. An unprejudiced report such as the official inspector is required to give, followed by the instruction and advice of a pathologist or competent field agent, should lead to improvements in methods of production and handling which would prevent much of this loss.

Pathological work on transportation, market and distribution troubles has already been carried on by the Department, especially in connection with apples, cranberries, strawberries, watermelons, potatoes and some other perishables. This new inspection service will provide opportunity for greatly extending and improving pathological work, and increasing publicity and educational work among growers, shippers, carriers, and distributors. It will also be a source of information and material for research and, what is of greatest practical importance, be a means of making field contacts with growers and shippers who are in most need of advice and instruction in methods of saving their crops. The pathological offices of the Department have already detailed men to assist the inspectors, collect data and follow up cases due to preventable causes, and endeavor

to have the proper remedy applied to prevent the occurrence of further cases of the same kind.

If it is a case in which spoilage is due to fungous disease, it should be followed to the point of origin and the field or extension pathologist, or county agent, who is working in coöperation with the market pathologist, can take up the matter with the grower or shipper and recommend the proper procedure to prevent the trouble in the future. The active coöperation of the extension pathologist and of the county agent should be secured to assist in getting the necessary remedy applied.

If the trouble is found to be due to some mistake or negligence on the part of the carrier, this should also be followed up and remedied so far as possible.

The market inspection work will require a thorough knowledge of the diseases and decays to which fruits and vegetables are subject, as the regulations provide that the certificates issued by the inspector shall state the nature of any unsound condition found, and this statement must be accepted by the courts as prima facie evidence. As the term "unsound" covers practically all of the forms of spoilage to which fruits and vegetables are subject, it is evident that the inspector must be not only familiar with fungous diseases, but with those forms of spoilage which arise from improper packages, methods of loading and storing, asphyxiation or smothering, and all of the various physiological troubles due to harvesting at improper stages of maturity, or handling under improper conditions of temperature and ventilation.

The various forms of unsoundness with which the inspector will have to deal may, therefore, be roughly classified as follows:

Non-fungous

- Insect injury
- Frost injury
- Mechanical injury
- Physiological troubles such as are produced by smothering and other abnormal functional conditions.

Fungous

- Parasites
- Saprophytes.

In order to coöperate with and assist the inspection service as far as possible, the Department pathologists are not only giving direct personal advice in the inspection work, but are preparing an illustrated manual and key to the various troubles likely to be met with by the inspectors.

The inspector's specific duties are fulfilled when he has determined the nature of any unsoundness in a shipment and certified the same to the shipper or his agent. This service will be of great value to the grower

or shipper in protecting him from unscrupulous dealers. The pathologist should, however, after the exact cause of the particular unsoundness has been determined, follow up the case and attempt to prevent such causes from occurring in later shipments from the same source. In order to accomplish this, a knowledge of the handling of the product from the field to destination will be necessary to determine whether the fault was due to the grower or shipper and his methods of growing, handling, packing, or loading, or whether it was due to some fault of the carrier in connection with refrigeration, delay in transit or delivery, or rough handling.

The greatest success in carrying out this project to prevent these enormous losses of vegetable food products and insure their delivery to the consumer in good condition can only be obtained by the most active and sympathetic coöperation on the part of all the agencies involved, which includes growers, shippers, carriers, distributors, inspectors and pathologists. The Railway Perishable Freight Association is taking an active interest in this work and its willingness to coöperate should be utilized in every practicable way.

Our greatest need just now, in order to perform most service in this line, is more men. The harvest is ripe, but the laborers are few and rapidly decreasing. Our Allies and our President have emphasized the need of having specially trained men and experts placed in positions where they can be of greatest service to the country and do most to hasten the successful termination of the frightful conflict which threatens to devastate the world.

"Food will win the war" is the slogan of the Food Administration. Is not the pathologist, in preventing these enormous losses of food, performing as effective service for his country as the man in the trenches?

BUREAU OF PLANT INDUSTRY
U. S. DEPARTMENT OF AGRICULTURE
WASHINGTON, D. C.

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(4) POWELL, G. HAROLL. The Food Administration and fruit and vegetable industry. Twenty-third annual convention of the International Apple Shippers Association, Aug. 16, 1917. Better Fruit, **12**: No. 4, 5, 20-23, Oct. 1917.

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BRIEFER ARTICLES

PERENNIAL MYCELIUM OF GYMNOSPORANGIUM BLASDALEANUM

J. S. Boyce

The telial stage of *Gymnosporangium blasdaleanum* (D. & H.) Kern, originally described as not deforming its host, has been shown by Meinecke[1] and Jackson[2] to be the cause of pronounced witches' brooms on Incense Cedar (*Libocedrus decurrens* Torrey.[3] Meinecke[4] stated that teliospores appear on the witches' brooms. Jackson[5] confirmed this by reporting perennial mycelium as very common in the tissues.

In addition to witches' brooms the perennial mycelium of this parasite is responsible for a form of hypertrophy not yet described. Mayr,[6] it is true, referred to an hypertrophy caused by *Gymnosporangium sp.*, which can hardly be other than *G. blasdaleanum* since this is the only rust ever found on Incense Cedar. However, as he did not give a description, his brief mention apparently has been overlooked until the present time. Harshberger[7] described a slightly similar hypertrophy on White Cedar, *Chamaecyparis thyoides* (L.) B. S. P., caused by *Gymnosporangium ellisii* (Berk.) Farl., now *G. myricatum* (Schw.) Fromme which is, however, confined to the smaller twigs and branches.

Spindle shaped swellings are commonly found on the branches or more rarely the trunks, of trees of all sizes. At times the swellings occur only on one side of a branch, the hypertrophy then resembling the muscles of the upper arm when partially contracted. The swellings may be quite pronounced. For example, on the trunk of one tree the normal radius just below the hypertrophy was 6 inches, while the center of the swelling showed a radius of 11 inches.

[1] Meinecke, E. P. Forest tree diseases common in California and Nevada. U. S. Dept. Agr. Forest Service Manual, pp. 35–37 Feb. 14, 1917.

[2] Jackson, H. S. A new pomaceous rust of economic importance. *In* Phytopathology **4**: 268 1914.

[3] Sudworth, George B. Forest trees of the Pacific Slope. U. S. Dept. Agr. Forest Service Oct. 1, 1908.

[4] Op. cit., p. 36.

[5] Op. cit., p. 267.

[6] Mayr, H. Die Waldungen von Nordamerika, p. 323 1890.

[7] Harshberger, J. W. Two fungous diseases of the white cedar. *In* Proc. Acad. Nat. Sci. Phila. **54**: 461–504 1902.

The swelling is the result of a very decided increase in the development of the wood with a negligible increase in the bast. The white sapwood and the light brown heartwood in cross section are conspicuously marked with numerous, very small, dark brown "flecks," either more or less following the annual rings in somewhat wavy lines or commencing at a definite point and spreading out centrifugally in a fan shaped manner, thus giving the wood a decidedly mottled appearance. In longitudinal sections these brown flecks appear as short, narrow, vertical streaks. An examination of over eleven hundred witches' brooms, revealed, without one single exception, the same brown "flecking." These flecks differ from the so-called pith-ray flecks[8] common to certain dicotyledonous tree species in that the latter are larger, scattered, tangentially arranged and not accompanied by a pronounced swelling of the host tissue.

Mycelium is found in abundance within these browned areas of the wood, in both the witches' brooms and the spindle shaped swellings. The hyphae from the wood of these two forms of hypertrophy are morphologically identical, not only in their individual characters, but in their relation to the host tissues.

Unless the highly improbable hypothesis, that the brown flecks are the result of individual consecutive infections, is admitted the mycelium must be remarkably long-lived. In the case of the trunk swelling mentioned before, it had persisted for more than two hundred years, while in a branch swelling it had endured for almost ninety years, as was shown by the continuation of hypertrophy in the youngest wood. The hyphae, of course, live only in the sapwood.

Not a single indication of the formation of telial sori has been found on the bark of any of the branch or trunk swellings. Indeed, it is difficult to imagine that the thick covering of dead bark encasing these hypertrophies could be ruptured by developing sori. No internal sori have been encountered. It appears, therefore, that the life of the fungus in these swellings is strictly vegetative.

Detailed studies are now being carried on in regard to all phases of this phenomenon in the life history of *Gymnosporangium blasdaleanum*.

OFFICE OF INVESTIGATIONS IN FOREST PATHOLOGY,
BUREAU OF PLANT INDUSTRY,
SAN FRANCISCO, CALIFORNIA.

[8] Brown, H. P. Pith-ray flecks in wood. U. S. Dept. Agr. Forest Service Circ. 215 May 7, 1913.

CULTURES OF AECIDIUM TUBULOSUM AND A. PASSIFLORIICOLA

H. E. THOMAS

The recent work of Dr. E. W. Olive and Prof. H. H. Whetzel[1] with the Aecidium-like rusts of Porto Rico, in which a number of those species were shown to be really telial, places the remaining unconnected species in a position of unusual interest. At the suggestion of Dr. J. C. Arthur the writer in the summer of 1917 undertook to determine by means of cultures the telial forms of *Aecidium tubulosum* Pat. & Gaill. on *Solanum torvum* Sw. and of *A. passifloriicola* P. Henn. on *Passiflora rubra* L. The spores of these two forms were germinated by Olive and Whetzel and shown to be truly aecial. Field observations were also made by them, which strongly indicated *A. tubulosum* might have genetic connection with *Puccinia substriata* Ellis & Barth., and *A. passifloriicola* with *P. Scleriae* (Paz.) Arth.[2] The writer also observed a number of instances in which these aecial and telial hosts, heavily rusted, were growing side by side.

To test these suggestions a set of cultures was planned. Plants of *Paspalum paniculatum* and *Scleria pterota* were potted and brought into an open plant house. Plants of each were atomized with a water suspension of aeciospores from the aecial hosts in question. These plants, together with controls were then covered with belljars from twenty-four to forty-eight hours.

Four sowings were made from Solanum to Paspalum, all of which developed infection. The sowing of May 28, 1917, gave an abundance of characteristic uredinia and telia of *P. substriata* on June 25, as shown by microscopic examination made by Dr. Arthur. Uredinia and telia on *Paspalum paniculatum*, collected on May 28 in the field by the side of the Solanum plants bearing aecia used for inoculation on same date, also proved by the same test to belong to *P. substriata*. A like inoculation made December 3, 1917, showed on December 21 a sparing amount of uredinia and telia, reported by Dr. Arthur to be the same species of rust.

With the sowings from Passiflora to Scleria considerable difficulty was experienced in getting conditions favorable to infection. However, two of four sowings produced some results. The one made September 5, 1917, on *Scleria pterota* Presl, showed urediniospores on September 15, and both urediniospores and teliospores on September 18. The micro-

[1] Endophyllum-like rusts of Porto Rico. Amer. Jour. Bot. **4**: 44–52, pl. 1–3. Jan. 1917.

[2] Olive and Whetzel, l. c., p. 46, and Arthur Uredinales of Porto Rico based on collections by H. H. Whetzel and E. W. Olive. Mycologia **9**:56, 74, 75, 88. March 1917.

scopic examination, as reported by Dr. Arthur, is especially interesting, for the spores are those characteristic of *P. Scleriae*, the teliospores having two and three cells, and not those of *P. scleriicola* Arth., or *Uromyces Scleriae* P. Henn., both occurring in the same region. The second successful sowing was made December 5, 1917, and gave a few uredinia December 21. A sowing of teliospores from *Scleria pterota* on leaves of *Passiflora rubra*, November 8, 1917, showed pycnia on November 24, but the development did not progress and on December 5, when a sample was taken to transmit to Dr. Arthur, only pycnia had formed.

As the controls remained free during the time of observation, and as the results correspond with the field observations, there seems to be no further doubt regarding the genetic relationship of the forms in question. This, I believe, is the first cultural proof of the full life cycle of any tropical grass or sedge rust.

AGRICULTURAL EXPERIMENT STATION
MAYAGÜEZ, PORTO RICO

SOME NEW OR LITTLE KNOWN HOSTS FOR WOOD-DESTROYING FUNGI. II

ARTHUR S. RHOADS

In a previous article[1] the writer called attention to the desirability of determining the hosts for wood-destroying fungi and recorded a number of unusual hosts for fungi usually confined to species of either coniferous or dicotyledonous wood. As in the case of the flowering plants, the importance of making collections of fungi purely for their taxonomic value has dwindled in comparison with the importance of their collection from the broader standpoints of their ecology and host relationships. By this statement, however, the writer does not intend to impugn the careful taxonomic study of the wood-destroying fungi but merely wishes to emphasize the need of their study along other lines that have thus far been seriously neglected.

In the present paper additional collections of wood-destroying fungi on unreported hosts are cited, mostly by reason of their departure from the usual coniferous or dicotyledonous hosts. In those regions in which the dominant timber is coniferous, wood destroying fungi, whose normal hosts are hardwood species, frequently occur on conifers. In regions, however, where the reverse situation occurs it is rarely indeed that wood-destroying fungi generally associated with dicotyledonous wood take up their growth on coniferous species.

[1] The first article appeared in Phytopath. **7**: 46–48. 1917.

Unless otherwise specified, all of the following collections were made by the writer and the specimens have been preserved.

Schizophyllum commune Fr.

On felled sapling of *Pinus virginiana*[2] (District of Columbia).

Pleurotus serotinus (Schrad.) Gill.

On stump of *Tsuga canadensis* (New York).

Hymenochaete agglutinans Ellis

On *Morus rubra*, causing a yellowish-brown heart rot in a small living sapling (Maryland).

On *Liquidambar styraciflua*, cementing together and killing twigs touching one another.

This fungus has been reported as being parasitic in twigs and small stems of a number of dicotyledonous trees and shrubs, but apparently has not been reported on the two species cited above.

Stereum sp. (?)

On a small dead branch of *Gingko biloba*, erumpent from lenticels (District of Columbia). The branch was submitted to Dr. E. A. Burt of the Missouri Botanical Garden for the identification of the fungus. Owing to the scanty material and its decided immaturity, however, it was only possible for Dr. Burt to say that "the fungus appears to be developing into a *Stereum*."

Guepinia spathularia (Schw.) Fr.

Growing out of season checks in rustic fence rails of *Juniperus virginiana* (Pennsylvania).

Polyporus dichrous Fr.

On fallen trunk of *Picea rubens* (New York).

On partially decorticated and standing dead tree of *Pinus virginiana* (Maryland). This fungus is usually confined to dicotyledonous wood.

[2] The nomenclature for trees used in this paper is that of George B. Sudworth. (Check list of the forest trees of the United States, their names and ranges. U. S. Dept. Agr., Div. Forestry Bul. **17**: pp. 144, 1898.)

Polyporus obtusus Berk.

Occurring as a wound parasite on *Fagus atropunicea* (Maryland). A large sporophore was found growing out of a living trunk at a point about 25 feet high where a branch stub had rotted back into the trunk. This fungus usually occurs on oak, and occasionally on black locust.

Polyporus versicolor Fr.

On a living tree of *Gingko biloba* (District of Columbia). A number of imbricate sporophores were growing on the exposed wood occasioned by a sawed-off branch. The specimens were collected by Mr. Roy G. Pierce of the Office of Investigations in Forest Pathology and deposited in the collections of this office (F. P., 18163).

Polyporus hirsutus (Wulf.) Fr.

On a living tree of *Gingko biloba* (District of Columbia). Several typical sporophores of this fungus arose from the outer sapwood at the edge of a creosoted cut necessitated by a broken limb. The antiseptic treatment seemed to be of little value in preventing the decay of the exposed wood. The specimens were collected recently by Mr. Carl Hartley of the Office of Investigations in Forest Pathology and have been deposited in the collections of this office (F. P., 24561).

This makes the third wood-destroying fungus here reported on gingko and is notable in that, with the exception of a few secondary fungi on dead and fallen leaves, apparently no fungi whatsoever have been reported on this tree. Moreover these findings are of added interest in that this is a gymnospermous host and the fungi enumerated rarely occur on other than dicotyledonous wood.

Polyporus pargamenus Fr.

On scorched bark at base of a fire-killed tree of *Pinus virginiana* (Maryland.—F. P., 23561). Two groups of typical sporophores were formed from the mycelium that had developed out of two insect tunnels about two inches apart in the bark. Typical sporophores of *Polyporus abietinus* occurring on adjacent parts of the bark presented a striking contrast.

In a previous article (l. c.) *Polyporus pargamenus* was reported as occurring on hemlock (*Tsuga canadensis*). These findings clearly indicate the fallacy of many writers in considering that this fungus is confined to dicotyledonous wood. From the standpoint of the arbitrary species these two types of sporophores are characteristic and distinct from one another even when occurring together on the same wood.

Polyporus gilvus (Schw.) Fr.

Occurring as a wound parasite on a living, liana-like stem of *Rhus toxicodendron* attached to the trunk of a living forest tree (Maryland.—F. P., 23636). The tree supporting the vine exhibited no sporophores of this or other wood-destroying fungi. On the side of the ivy stem away from the trunk, two good sized sporophores were borne close together on what appeared to have once been a longitudinal crack. The greater part of the increment of the vine had been made on the side opposite the sporophores. The central portion of the liana-like stem exhibited a yellowish-brown rot which contrasted strongly with the peripheral living portion. The fungus presented a clear case of wound-parasitism and subsequent heart rot.

Although many poisonous plants are subject to fungous diseases, but very few fungi have been reported on such plants as poison ivy and poison sumach. In addition to the parasitic occurrence of *Polyporus gilvus* on the former host, as noted above, the writer has collected a number of saprophytic wood-rotting fungi upon these two plants as follows:

Irpex lacteus Fr. on a small dead stem of *Rhus toxicodendron* (Maryland). *Stereum rameale* Schw., *Polyporus pargamenus* Fr., *Polyporus versicolor* (L.) Fr., and a number of undetermined species on dead trunks of *Rhus vernix* (Virginia).

OFFICE OF INVESTIGATIONS IN FOREST PATHOLOGY,
BUREAU OF PLANT INDUSTRY,
WASHINGTON, D. C.

REVIEWS

The Beet Leafhopper and the Curly-Leaf Disease That It Transmits. E. D. Ball. Bull. 155, Utah Agri. Expt. Sta., pp. 1–56, pls. I–VI, figs. 1–5, Logan, Utah, June, 1917.

The writer wishes to call the attention of plant pathologists to this bulletin, which is of interest to the entomologist and pathologist alike. No other person than Dr. Ball could discuss this interesting and important subject from so broad a point of view, on account of his original discovery of the connection between curly leaf and *Eutettix tenella* and his subsequent study of the problem all over the affected region, irrespective of state lines.

The bulletin contains a full review of existing knowledge of the disease and its insect carrier, together with a considerable amount of new material. Of the latter, the accounts of the history and distribution of the disease, the periodicity of its outbreaks, its economic importance, and the relation of environmental conditions to its occurrence are particularly valuable.

In regard to the insect, the author, from his broad knowledge of the whole problem, is able to present the matter in such a way as to correlate all the existing information concerning the habits of *Eutettix tenella* with that in regard to the beet disease. Of particular interest in this connection are the author's ideas as to the migration of the insect in vast numbers for distances of even several hundred miles, thus producing sudden and disastrous outbreaks of curly leaf. No positive proof of this important fact is offered and, for the complete elucidation of the disease problem, it is to be hoped that this will stimulate further investigation concerning the life history of the insect during the period between its disappearance from the beet fields in the fall and its appearance the following spring.

Those interested in some of the other so-called "physiological" plant diseases will find this publication of interest.

RALPH E. SMITH

PHYTOPATHOLOGICAL NOTES

Infected grass seeds and subsequent rust development. McAlpine, in "The Rusts of Australia," notes: "In the case of cereals and grasses, the rust spores would probably be brought with the seed and this is certainly true as regards *Puccinia beckmanniae*. The seed of *Beckmannia, erucaeformis* Host. was forwarded to me in 1903 by the United States Department of Agriculture, and on growing it at Leongatha, the rust was very copiously developed in February and March, 1904. E. W. D. Holway informs me that it is known in Minnesota, U. S. A., although it has not hitherto been published.

The seed of *Elymus condensatus* was also sent from America in 1903, and the rust (*Puccinia impatientis*) appeared upon the plants in December of the same year."

E. W. D. HOLWAY

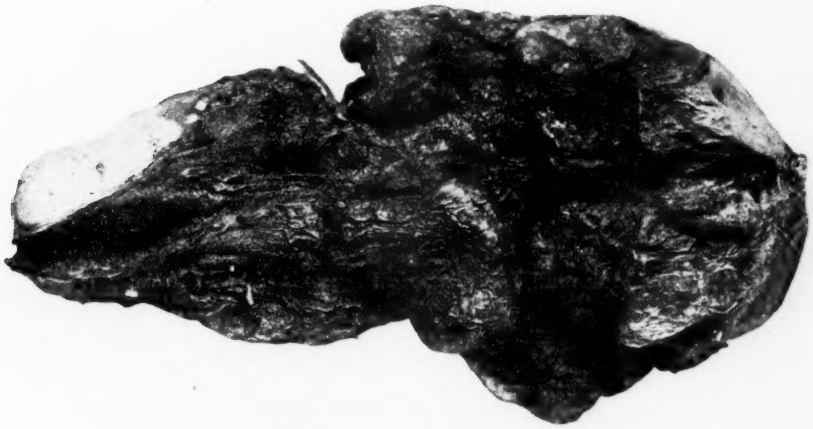

FIG. 1. SWEET POTATO INJURED BY NEMATODES

Nematode injury to sweet potatoes. Sweet potatoes showing very severe nematode injury were sent to the Arkansas Experiment Station in September last, from two counties in southern Arkansas. It was thought that the injury was unusual enough to be of interest to other pathologists. Both crops were grown in sandy soil. One farmer reported having 10 acres of potatoes which were unsalable on account of the disease; the other lost 700 bushels of potatoes. The nematodes were very numerous in the roots to the depth of 1 cm. and in some cases were found as deep as 3 cm. The illustration shows the severity of the injury.

JOHN A. ELLIOTT

Report of the Special Committee appointed to formulate the attitude of the American Association of Official Horticultural Inspectors on the question of prohibiting the importation of nursery stock from foreign countries.

WHEREAS our country is now and has for many years suffered serious financial loss from the activity of insects and plant diseases that have come to us from abroad, the annual damage by a single insect in some cases being greater than the total value of all nursery stock imported in the course of a year,

WHEREAS the means of communication between the countries of the world have developed to a point that all regions are now reached through the regular channels of commerce in a portion of the time formerly required,

WHEREAS by reason of this great improvement in transportation, species of injurious insects, now confined to foreign countries, are certain soon to be introduced into our country through the importation of foreign plants,

Be it resolved:

1. That the importation of all nursery stock as designated in the Plant Quarantine Act of August 20, 1912, should be prohibited except as brought in under carefully guarded quarantine regulations of the U. S. Department of Agriculture.

2. That the prohibition against nursery stock coming in with soil about the roots should be placed at once.

3. That the prohibition against all other kinds should be placed with due regard to the time necessary to enable the businesses affected to adjust themselves to the change, after which absolute prohibition should obtain.

THOMAS J. HEADLEE
[SIGNED] GEO. A. DEAN
E. D. BALL

Plant quarantine legislation. The following bill was introduced into the United States Senate on January 4, 1918:

To prohibit the importation of nursery stock into the United States in order to prevent the introduction of insect pests and plant diseases. *Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,* That it shall be unlawful for any person to import or offer for entry into the United States any nursery stock: *Provided, however,* That the Secretary of Agriculture may import, grow, and propagate such nursery stock for experimental and scientific purposes, which, after holding in quarantine a length of time sufficient to establish its freedom from insect pests and plant diseases, he may distribute upon such conditions and under such regulations as he may devise.

SEC. 2. That the Secretary of Agriculture shall provide for the inspection, fumigation, detention, and propagation of all plant materials imported by him and shall

devise such rules and regulations as may be necessary for carrying out the purposes of this Act.

SEC. 3. That any person who shall import or offer for entry into the United States any nursery stock or shall violate any of the provisions of this Act shall be deemed guilty of a misdemeanor and shall upon conviction thereof be punished by a fine not exceeding $1,000 or by imprisonment not exceeding one year or by both such fine and imprisonment in the discretion of the court.

SEC. 4. That for the purpose of this Act the term "nursery stock" shall include all field-grown florists' stock, trees, shrubs, vines, cuttings, grafts, scions, buds, fruit pits and other seeds of fruit and ornamental trees or shrubs, and other plants and plant products for propagation, except field, vegetable, and flower seeds, bedding plants, and other herbaceous plants, bulbs, and roots.

SEC. 5. That the word "person" as used in this Act shall be construed to import both the plural and the singular, as the case demands, and shall include corporations, companies, societies, and associations. When construing and enforcing the provisions of this Act, the act, omission, or failure of any officer, agent, or other person acting for or employed by any corporation, company, society, or association, within the scope of his employment or office, shall in every case be also deemed to be the act, omission, or failure of such corporation, company, society, or association, as well as that of the person.

SEC. 6. That this Act shall become and be effective from and after the first day of July, nineteen hundred and eighteen.

The present attitude of the Bureau of Plant Industry and the Federal Horticultural Board is expressed by the following official statement:

MEMORANDUM REGARDING THE PROHIBITION OF THE IMPORTATION OF NURSERY STOCKS INTO THE UNITED STATES

Numerous inquiries have been received by the Department regarding the prohibition, in order to prevent the introduction of insect pests and plant diseases, of the importation of nursery stock into the United States, except for experimental or scientific purposes by the United States Department of Agriculture, effective July 1, 1918.

The experts of the Department have given careful consideration to this matter and also to the proposal regarding the immediate exclusion of certain classes of nursery stock and the exclusion of other classes after the expiration of a reasonable period to permit adjustment of the interests affected.

As to the need of additional Federal plant quarantine powers, it may be pointed out that the Federal Plant Quarantine Act of 1912, as amended, gives authority to enforce any prohibitions or other restrictions on the importation of nursery stock or other plants and plant products necessary to prevent the introduction of insect pests and plant diseases. Under this Act there are now in force 11 foreign quarantines prohibiting, and 8 orders regulating, the entry of plants and plant products. This Act includes not only the plants actually described as "nursery stock," but also any other class of plants or plant products the entry of which it may be desirable to restrict or prohibit. Furthermore, wherever the necessity therefor arises, in order to prevent the introduction of dangerous diseases or insects, the importation of whole classes of plants, or those coming from specified world regions can be prohibited or regulated.

As a result of the consideration which the experts of the Department have given the matter, it appears very doubtful whether the horticultural development of this country has reached the point where the complete exclusion of foreign nursery stock in order to prevent the introduction of diseases and insects could have other than harmful effect. Precipitate action at this time would give no opportunity for readjustment to those phases of the industry which would be most seriously affected and would greatly handicap plant propagators of the United States and work financial injury to many branches of horticulture. At the present time there is no available supply of stocks in this country for the production of many kinds of fruits and ornamentals, nor is it possible now to obtain from domestic sources seeds from which several of these stocks can be grown.

The situation, therefore, calls for constructive action. Before any general program of exclusion, if such should be necessary to protect this country against insects and plant diseases, could he intelligently considered, more information is needed concerning the importations now being made, the necessity therefor, as well as the existence and geographical distribution of foreign plant parasites likely to be introduced with such importations. This information is now being accumulated by the branches of the Department dealing with such matters. The Bureau of Plant Industry is extending its studies of nursery problems to secure definite information regarding the kinds and quantities of plant material grown abroad and introduced as seeds and stocks or materials for forcing; the practicability of growing these seeds and stocks and other plant materials in this country; encouragement of local activities for the production of plant materials we now import, including seeds for such stocks as pear, peach, cherry, apple, and other fruits; and the determination of localities in the United States where stocks and similar plant materials may be successfully grown. Several field stations, well located, equipped, and organized, are already available for this work, and valuable records, the accumulation of nearly twenty years' world-wide explorations, also are at hand for immediate use.

Much of this work will be carried out through the Office of Foreign Seed and Plant Introduction of the Bureau of Plant Industry. This Office is charged with all matters relating to the introduction for this Department of foreign seeds, plants, bulbs, etc., for scientific and experimental purposes and cooperates with the Federal Horticultural Board in maintaining facilities for inspection and quarantine. This Office has already been the means of introducing, testing, propagating and distributing many new plants, including among these a number of promising disease-resistant pears, peaches, cherries, roses, and other plants which are now being propagated and tested preparatory to their more widespread use.

The experts of this Department feel that every reasonable effort should be made to stimulate the propagation in the United States of necessary plant stocks in order to eliminate the danger of bringing in dangerous plant diseases and insect pests. In any event, if, in order to protect this country against such plant diseases and insects, it should become necessary to consider the complete exclusion of nursery stock, the matter should develop gradually, affording opportunity for adjustment, rather than result from immediate and drastic action. In the meantime, under the existing Plant Quarantine Act, quarantine action in addition to that now in force can be promptly taken as to any plant or class of plants or plant products whenever it is evident that the danger outweighs the sacrifices involved.

Botanical abstracts. A meeting of editors of botanical publications was held at Pittsburgh, December 28, 1917, to consider the desirability of

undertaking the publication of an abstracting journal for botany. After a long discussion the following resolution was adopted:

Resolved, that we, as a meeting of botanists interested, invite each botanical society to appoint a committee of two to meet with committees of other societies and with the members of this meeting, to formulate a program for a journal of botanical abstracts, botany to be interpreted in its broadest sense. In case action of any society is delayed, the president and secretary of such society are invited to represent them. A meeting is called for 10 a.m., December 30, at Parlor 140, Fort Pitt Hotel.

At the augmented meeting, after informal discussion, it was voted that the 26 botanists present proceed to formal organization under the name "Committee on Botanical Abstracts." Donald Reddick was elected Chairman and Forrest Shreve Secretary. On motion it was voted that the Committee provide for its perpetuation in the following way:

(1) That the following botanical organizations be asked to elect two members each:

Botanical Society of America, Taxonomic Section
Botanical Society of America, Physiological Section
Botanical Society of America, General Section
American Phytopathological Society
Ecological Society of America
Society for Horticultural Science
American Society of Agronomists
Society of American Bacteriologists
Society of American Foresters
American Society of Naturalists
American Genetic Association
Section G, American Association for the Advancement of Science
The Paleontological Society of America
American Microscopical Society
American Society of Pharmacognosy

(2) That in the election of members to the "Committee on Botanical Abstracts" the societies be asked to name one man for a short term of two years and one man for a long term of four years, and that they elect a member biennially thereafter or as required.

On motion the Committee elected by ballot a Temporary Committee on Organization, of ten persons, to act for one year with power to make arrangements for editorial management and publication. This committee is constituted as follows:

Donald Reddick, chairman
J. H. Barnhart
H. C. Cowles

B. M. Duggar
C. S. Gager
R. A. Harper
B. E. Livingston
F. C. Newcombe
C. L. Shear
Forrest Shreve

The Temporary Committee selected B. E. Livingston for Editor-in-Chief and the following as associate editors in charge of the sections as indicated:

Agronomy and Soil Technology, R. W. Thatcher
Bacteriology, H. J. Conn
Botanical Education, C. Stuart Gager
Cytology, C. J. Chamberlain
Ecology and Plant Geography, H. C. Cowles
Forestry, I. W. Bailey
Genetics, G. H. Shull
History, Biography and Bibliography, J. H. Barnhart
Horticulture, W. H. Chandler
Morphology, E. W. Sinnott
Paleobotany, E. W. Berry
Pathology, Donald Reddick
Pharmacognosy, Henry Kraemer
Physiology, B. M. Duggar
Taxonomy, William Trelease, J. M. Greenman, J. G. Schramm

It is expected that the work of abstracting will begin at once with the international literature of the year 1918 and that publication will follow promptly.

Personals. Mr. J. A. McClintock has resigned his position as plant pathologist at the Virginia Truck Experiment Station to accept a position as assistant in plant pathology in the Bureau of Plant Industry, Office of Cotton, Truck, and Forage Crop Disease Investigations. Mr. McClintock will be engaged in pathological extension work in the state of Georgia, with headquarters at the State University at Athens.

Mr. Max W. Gardner, lately instructor in plant pathology in the University of Michigan, has accepted an appointment as scientific assistant in the Bureau of Plant Industry.

LITERATURE ON PLANT DISEASES[1]

COMPILED BY EUNICE R. OBERLY, LIBRARIAN, BUREAU OF PLANT INDUSTRY, AND FLORENCE P. SMITH, ASSISTANT

January, 1918

Arnaud, Gabriel. Le faux black-rot du Var. Rev. Vit. **47:** 357–360, illus. D. 1917.

Guignardia baccae.

——— La rouille du ricin (Uredo ricini Biv.). Bul. Soc. Path. Veg. France **4:** 37–39. O. 1917.

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——— Tumeurs du Phillyyrea [sic] angustifolia et du Chænomeles japonica. Bul. Soc. Path. Veg. France **4:** 55–56. O. 1917.

Belgrave, W. N. C. A preliminary note on "brown bast." Agr. Bul. Straits and Fed. Malay States **6:** 1. O. 1917.

First thought to be a new species of Spongospora but later considered possibly to be one of the lower forms of algae.

——— and **Norris, F. de la Mare.** Notes on bark cankers and their treatment. Agr. Bul. Straits and Fed. Malay States **6:** 2–10. O. 1917.

"Claret coloured" bark canker, *Phytophthora fabori;* black-stripe canker; mouldy rot of recently tapped surface, *Sphaeronema* sp.

Blackman, Vernon Herbert, and **Welsford, Evelyn Janie.** Studies in the physiology of parasitism. II. Infection by Botrytis cinerea. Ann. Bot. **30:** 389–398, pl. 10. Jy. 1916.

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Parts I, III–IV were written by William Brown.

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Studies from the Pathological laboratory V.

Brooks, Charles, and **Fisher, Durward F.** Irrigation on experiments on apple-spot diseases. Jour. Agr. Research **12:** 109–138, 10 fig., pl. 2–5. Ja. 21, 1918.

Literature cited, p. 136–137.

Brown, William. Studies in the physiology of parasitism. I, III–IV. Ann. Bot. **29:** 313–348, Jy. 1915; **30:** 399–406, Jy. 1916; **31:** 489–498. O. 1917.

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I. The action of Botrytis cinerea.

II. Infection by Botrytis cinerea. See Blackman, V. H., and Welsford, E. J.

III. On the relation between the 'infection drop' and the underlying host tissue.

IV. On the distribution of cytase in cultures of Botrytis cinerea.

[1] This list includes references, both American and foreign, to the literature of plant pathology and mycology of interest to pathologists. Foreign references published since January 1, 1917, have been included beginning with the list appearing in v. 7, no. 3, June, 1917.

All authors are urged to coöperate in making the list complete by sending their separates and by making corrections and additions, and especially by calling attention to meritorious articles published outside of regular journals. Reprints or correspondence should be addressed to Miss E. R. Oberly, Librarian, Bureau of Plant Industry, U. S. Dept. Agri., Washington, D. C.

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REPORT OF THE NINTH ANNUAL MEETING OF THE AMERICAN PHYTOPATHOLOGICAL SOCIETY

The ninth annual meeting of the Society was held in the Carnegie Institute of Technology, Pittsburgh, Pa., December 28, 1917 to January 1, 1918, in conjunction with the American Association for the Advancement of Science and the Botanical Society of America.

About sixty members were present, and a program of forty-four papers, abstracts of which appeared in the February number of PHYTOPATHOLOGY, was presented. Fifteen new members were elected, making the total membership three hundred and eighty-seven.

Joint sessions were held with Section G of the American Association for the Advancement of Science and also with the Botanical Society of America.

The following officers were elected:

President, Dr. E. M. Freeman, Department of Agriculture, University of Minnesota, St. Paul, Minn.

Vice-president, Dr. C. W. Edgerton, State Experiment Station, Baton Rouge, La.

Councilor for two years, Dr. L. R. Jones, University of Wisconsin, Madison, Wis.

Chief editor of PHYTOPATHOLOGY *for three years*, Dr. Wm. A. Orton, U. S. Department of Agriculture, Washington, D. C.

Member of editorial board to fill unexpired term of Dr. Orton, Dr. E. C. Stakman, Department of Agriculture, University of Minnesota.

Associate editors for three years, James T. Barrett, Citrus Experiment Station, Riverside, Cal.; F. D. Fromme, Virginia Polytechnic Institute, Blacksburg, Va.; I. E. Melhus, Iowa State College, Ames, Iowa; W. J. Morse, Agricultural Experiment Station, Orono, Me., and *for two years, to fill the unexpired term of E. C. Stakman*, N. J. Giddings, Agricultural Experiment Station, Morgantown, W. Va.

Business manager of PHYTOPATHOLOGY *for one year*, C. L. Shear.

The Society decided to hold its next annual meeting at Boston, Mass., in conjunction with the American Association for the Advancement of Science, December 27–31, 1918, and should the Association change its place of meeting the Society will do likewise.

REPORTS OF COMMITTEES

Committee on Common Names of Plant Diseases, consisting of G. R. Lyman, C. W. Edgerton, J. B. S. Norton, E. C. Stakman, and Wm. A. Orton, presented the following report through its Chairman:

At the New York meeting last year the Society voted that the Committee on Common Names of Plant Diseases be directed to prepare a list of proposed common names and submit same by mail, in the form of a ballot, to the members of the Society, these to be returned to the Chairman of the Committee and the approval of three-fourths of the membership of the Society to be necessary for the adoption of any one name. The Committee is now preparing the list, in accordance with above directions, and will shortly submit it to the members of the Society. Inasmuch as there will be difficulty in securing a sufficient number of votes to permit of the adoption of any name it is proposed to include in the list only those names concerning which there appears to be little difference of opinion among pathologists. The members are urged to return their ballots promptly.

Committee on Ways and Means made no report, the Chairman being absent.

Committee on the Schweinitz Collection of Fungi reported through its Chairman, C. L. Shear, that the Schweinitz collections are being arranged by the Academy of Science and the Committee as rapidly as conditions will permit.

Committee on Summer Meetings was discharged on request of one of its members.

Committee on Pure Culture Supply Laboratory presented a report through its Chairman, C. L. Shear, to the effect that this project had been approved as a part of the work of the Bureau of Plant Industry and placed in charge of Dr. G. R. Lyman, to be carried on in connection with the work of the plant disease survey. Dr. Lyman reported that he is undertaking a careful survey of the field in order to determine, so far as possible, the nature and scope of the work, and make a beginning, in a small way at least, during the present fiscal year, war emergency work making it impossible to develop the project at present as rapidly as might seem desirable.

Committee on a standard chart for percentage estimates of injury to diseased plants, consisting of L. R. Jones, V. B. Stewart, and H. B. Humphrey, made a report of progress through Dr. Stewart, the Chairman being absent. The report was adopted and the Committee continued.

REPORT OF TREASURER OF SOCIETY, 1917

Receipts:

Balance from 1916	$129.94	
Membership dues	1,719.81	
Interest	23.81	
Reimbursement by PHYTOPATHOLOGY for items paid from Society funds	2.49	
		$1,876.05

Expenditures:

PHYTOPATHOLOGY appropriation	$200.00	
Member subscriptions to PHYTOPATHOLOGY	1,004.00	
Clerical work	77.37	
Supplies	75.05	
Printing	57.92	
Travel	19.05	
Member bills for clerical work	5.95	
Exchange on foreign remittances	.20	
Foreign money order for member's dues returned by bank	3.36	
		1,442.90
Balance in bank		$433.15
Due sinking fund account, 83 sustaining life members and 1 pledge		420.00
Actual balance		$13.15

FINANCIAL STATEMENT OF BUSINESS MANAGER OF PHYTOPATHOLOGY, 1917

Receipts:			
Balance from 1916		$ 143.52	
Appropriation from American Phytopathological Society for 1917		200.00	
Advertising guarantee, 1916		150.00	
Subscriptions and sales, PHYTOPATHOLOGY		928.57	
Member subscriptions		1,004.00	
Subscription to proposed index		38.50	
Interest on sinking fund		30.00	$2,494.59
Expenditures:			
Manufacture of Journal:			
No. 6, Vol. VI	$152.14		
No. 1, Vol. VII	357.41		
No. 2, Vol. VII	333.40		
No. 3, Vol. VII	354.69		
No. 4, Vol. VII	402.05		
No. 5, Vol. VII	320.70	$1,920.39	
Reprint of index to Vol. V		$36.22	
Miscellaneous bills of publishers		79.42	
Clerical work		50.64	
Insurance		5.40	
Transfer of member dues paid direct to publishers, etc.		3.85	2,095.92
Balance			$398.67

On motion the chairman appointed an auditing committee, consisting of I. C. Jagger and G. R. Bisby. The committee reported that it examined the accounts and found them correct and this report was adopted.

RESOLUTION ADOPTED

On motion the following resolution was presented and adopted, the same resolution having been adopted by the Botanical Society of America and Section G of the American Association for the Advancement of Science:

"WHEREAS, in the present National emergency, the increased production of foodstuffs and the greatest possible efficiency in the use and administration of plant products are imperative as war measures;

"WHEREAS, material progress may be made toward securing these objects by the more extensive and immediate application to agriculture of the results of botanical research, especially along the lines of plant disease control and the general improvement of cultural methods;

"WHEREAS, the botanists of the United States are ready and anxious to cooperate in every way in the advancement of war projects, but are handicapped in their efforts by inadequate organization, insufficient funds, and the loss of many highly trained men who are being called to military service;

"WHEREAS, immediate concentration on the most important problems is necessary if an effective campaign for increasing our agricultural resources is to be carried on during the coming season; therefore, be it

"*Resolved:* That committees should be appointed by the various botanical societies to prepare definite plans for the immediate mobilization of the botanists of the United States and for their more effective cooperation in the prosecution of war work, said plans to be referred to the Botanical and Agricultural Committees of the National Research Council, with a request for their active cooperation and assistance; and further

"*Resolved:* That the Botanical and Agricultural Committees of the National Research Council be requested to take such steps as may be necessary to secure the detailing to special agricultural duty of those botanists who may have been called to military service, but who are found essential to the successful prosecution of botanical war work."

G. R. LYMAN
C. L. SHEAR
L. H. MACDANIELS
Committee of Section G, A. A. A. S.

Following the adoption of this resolution a War Emergency Board was appointed to cooperate with similar committees of the Botanical Society of America and Section G of the Association in carrying out the provisions of the resolution. The Commission consists of H. H. Whetzel, Chairman, H. P. Barss, E. C. Stakman, G. H. Coons, Frank D. Kern, G. R. Lyman, and H. W. Barre.

MISCELLANEOUS BUSINESS

The Secretary's report of the Eighth Annual Meeting as published in No. 2 of Vol. VII of PHYTOPATHOLOGY was adopted, with the correction that H. S. Jackson was elected councilor for two years instead of three years.

On motion the Society voted to appropriate two hundred dollars from any available funds for the use of PHYTOPATHOLOGY in 1918.

The Society affirmed its action at the previous annual meeting providing that because of lack of time and space no member should be allowed hereafter to present more than two papers at any one meeting except by invitation, and that in the case of joint authors the paper should be charged to the author presenting it. The original action of the Society was accidentally omitted in the report of the Eighth annual meeting.

The Board of Editors voted to continue the present list of literature during 1918. It also reaffirmed its decision to carry out the plan for monthly publication of PHYTOPATHOLOGY.

The report of the retiring chief editor, Dr. Donald Reddick, was read and accepted. This report will be published elsewhere in the JOURNAL.

On motion it was voted to require the payment of members' dues by December 20 in the future.

It was also decided that as the next annual meeting will end the first decade in the history of the Society some special feature in recognition of this be provided for in the program.

On motion C. L. Shear and W. J. Morse were appointed a committee to represent the Society in the committee on organization of the proposed botanical abstract journal. The committee attended the meeting and reported the action of the organization board, requesting the American Phytopathological Society to select two members of the board of control of botanical abstracts. On motion the president was directed to appoint two members as desired, and Dr. Donald Reddick was appointed for four years and Dr. C. L. Shear for two years.

On motion the Council was directed to appoint a committee of twelve members on standardization of cultural technique and forms of reference and terminology to be used in publication.

On vote it was recommended that arrangements be made at future meetings for informal sessions for the discussion of certain papers accompanied by exhibits.

On motion the secretary was directed to send greetings of the Society to Dr. L. R. Jones and Dr. B. D. Halsted.

A vote of thanks was tendered to the local committee for the accommodations provided for the Society and the many courtesies extended during the meeting.

C. L. SHEAR,
Secretary-Treasurer.

REPORT OF THE CHIEF EDITOR

The opinion seems to be very general among investigators in plant pathology that the all-important part of their work is the research in which they are engaged. Comparatively few seem to realize that it is just as important to set down in concise, clear language a statement of their results and their theories, as it is to have performed the work or made their deductions.

The following observations and reflections are set down for what they are worth, but particularly with the hope that they may attract the attention of the younger men and those who have yet their first papers to present to a scientific journal. The older men are more likely to have had training in colleges of arts, but in any case are so set in their ways that they cannot be expected to take an interest in innovations.

Various criticisms have been made of PHYTOPATHOLOGY. Among the common ones are: that some of the researches presented are not of a very high order; that many of the articles are filled with irrelevant details; that the author's contribution is buried in a mass of compilation under the caption *Review of Literature*; and so forth.

To the first criticism the following reply may be made. In the official organ of a democratic society the editors are bound to accept all matter on an equal basis provided only that it attain a certain more or less indefinable scientific standard. In thus publishing creditable research from any member, the journal may perform a very distinct service to the contributor and to the science.

To the second and third criticisms many others of a somewhat similar nature might be added, particularly with reference to the manuscripts as originally submitted. It is true that preparation of manuscript and illustrations for publication, methods employed by the printer and the engraver, proofreading, and the like, rarely are taught in the schools and colleges with the result that persons fully trained in methods of research and performing valuable work find themselves at a loss to prepare their results for publication. A little reflection on some of the common errors made by contributors to PHYTOPATHOLOGY, with suggestions as to how they may be avoided, may not be amiss.

Excessive detail. The recent trend of research in plant pathology has been towards a keener analysis of attendant circumstances and has resulted in greater precision, accuracy and completeness of statement than was formerly the case. Already it has been carried to excess by some, with the result that some of our recent papers are cluttered up with irrelevant detail. It is time now that this society took stock of the situation, and made provision for reducing the number of printed

pages necessary to present its researches by adopting some standard methods of procedure. This has already been done by the chemists, the water bacteriologists, and some other groups of scientists. We have in reality developed a technique for doing a great number of things. What we need now is a large permanent committee on standardization of methods, in order to avoid repeated description in the text.

If the proposal needs defense it might be justified on the basis of general efficiency. There is the most urgent need at the present time to speed up research in order that it may at least keep pace with teaching and extension. There should be no fear that such a committee or the adoption of the proposed methods would in any way have the slightest influence or directing power on research; in fact it is a plan to stimulate originality by providing stereotyped ways of handling matters which are only handles to productive research, and of bringing original matter to readers in the undiluted form and not surrounded by the exasperating verbiage of minute detail.

Our literature has already accumulated to such an extent, and is in such a state of disorder, that it is often easier to perform an experiment and learn what the facts may be than to search through the books and periodicals to find what some one else thinks they are. The above proposal would help to reduce the number of printed pages, and thus shorten the labors of those who are more interested in doing things.

Tabular matter. But there are other ways of reducing the number of printed pages and at the same time improving our records. One of these is in the use of tables. The primary object of a printed table is to present a mass of detailed and replicated observations or records. Such tables save an endless amount of repetition. But another type of table is constantly appearing in manuscripts submitted for publication; they are compiled only for the benefit of the author in making a conclusion, and their contents could be presented much better in a few sentences. Incidentally the cost of composition of tabular matter in these days of the monotype is just double that of regular matter.

Details about extreme accuracy. There is a noticeable tendency for authors to call attention repeatedly to the extreme accuracy with which certain records have been made. It is fair to presume that every one thinks he works with accuracy, but the best indication of the accuracy employed is in the records themselves. If a statement regarding accuracy is needed it might well be incorporated in a few sentences at the beginning of the article, so that it might be passed over by those who are personally acquainted with the author and have first-hand knowledge of his methods of work. It is not scientific to employ an extreme degree of accuracy in one part of a research when the refinements in technique do not permit the same degree of accuracy at other and perhaps more vital stages in the investigation. A single example will suffice, but many others could be mentioned. Chemicals of a high degree of purity are procured, weighed to four decimal places according to the most recently published statement of atomic weight, and then mixed without the slightest compunction with an unknown chemical complex—agar.

Irrelevant matter. Certain of the attendant circumstances of an investigation are of the greatest importance, but authors would do well to scan their manuscripts for sentences which have not the slightest bearing on the scientific record. It is a well-known fact that authors cannot criticize their own manuscripts intelligently unless a considerable interval of time elapses between the writing and the review. Proper criticism from a colleague will help to eliminate matter not having a direct bearing on the subject, and a review by one not at all acquainted with the subject matter usually results in a marked improvement of style and diction. Perhaps

the best way of emphasizing the importance of this phase of publication aside from the burden placed on the reader, is to state that under the conditions of issuing PHYTOPATHOLOGY the cost per printed word is nearly 1 cent.

Illustrations. The excellent short article on *Illustrating Botanical Papers*, by Barnes, published ten years ago (Bot. Gaz. 43: 59–63. 1907), should be in the hand or in the mind of any one who contemplates submitting illustrations with an article. Except for some of the newest types of reproducing illustrations (such as the photogelatin process and color work), Professor Barnes has covered the subject exhaustively but succinctly. The article was reprinted and was for a long time available on application to the *Botanical Gazette*. If it is no longer available this society should have a reprint made to distribute to members and others. The only thing that need be added at the present time is a paragraph on the purpose of illustrations. Judging by the kinds of illustrations submitted to PHYTOPATHOLOGY for publication, it would appear that a great many authors do not appreciate fully either the value or the expense of inserting an illustration, or the distinction between illustrating an article for farmers to read and one for their colleagues. This is particularly true of photographs. Presumably an illustration is used to make clear a point that cannot be explained readily in the text; but it is not at all uncommon to find manuscripts in which no reference whatever is made to the illustrations submitted with it. Nor is it uncommon to find illustrations that have no particular bearing on the specific problem under discussion—a pretty picture perhaps showing a pine tree from which a block of wood was taken for experiment, or perhaps a beautiful cloud effect with a decayed stump in the foreground as an excuse for publishing. Authors do not seem to realize that the charge for making the engraving is nearly 20 cents per square inch and that PHYTOPATHOLOGY is not an art journal. To the engraver's charge must be added a regular charge of 1 dollar per engraving for *make-ready*, a process of intensifying detail and eliminating most of the background clouds and all. Many authors apparently do not even bother to read the instructions about illustrations printed in every issue of PHYTOPATHOLOGY.

The amount of reduction is rarely considered by authors. Some say reduce as little as possible, others leave the whole thing to the editor, and one author has objected to having his illustration reduced although it was only brought down to fit the regular type page. Some authors use index numbers or letters which will not stand reduction, although reduction is necessary, and others use indices large enough to stand three-fourths reduction when only one-fourth off is desired for the drawings.

Bibliographical citation. It has been the intention of the editors to employ in PHYTOPATHOLOGY the Madison code of bibliographical citation. Members have been notified of this fact and a copy of the code has been sent to every member. Notwithstanding this and the fact that this code is used in our best-known and oldest American botanical periodicals, it is the rule rather than the exception to find manuscripts submitted in which a different method of citation is employed, very often a method which if allowed to appear in print would stand as permanent evidence of the laziness of the author or of his indifference to the comforts and convenience of others.

It would be good economy of space to reduce the citation to the bare necessities, as is done in the *American Chemical Journal;* but it is to be noted in this connection that many citations are not correct, and some are so hopelessly incorrect that the article to which reference is made cannot be located. By employing the Madison code there are more chances that some part of the citation will be transcribed correctly.

In the same way tables containing computations, in which enough data are given to check them, usually show mistakes. Sometimes the mistakes are so serious as to alter completely the conclusions drawn. Such errors occur not only in the work of young and inexperienced men but in that of the oldest veterans.

Use of terms. A surprisingly large number of authors do not employ the same accuracy in expressing their thoughts that they do in performing their experiments. This does not refer to the fine distinctions that might be regarded as merely academic, but to the commonest expressions. Many papers are presented for publication in which the laboratory vernacular has been employed freely. It leads to such expressions as the following: spores of anthracnose, infected soil, dissemination of a disease, the disease causes . . . ., quite . . . . (often used quite right—but more often not quite right), colony of a fungus, epidemic for epiphytotic, maladay for disease, infected and effected for affected, inoculate for infect, infection period for incubation period, and so forth.

Mechanical features of publication. During the writer's incumbency no contributor has submitted or even suggested a running head for his article, although a few have objected to the running head selected by the editor. It is the custom to have a short title at the head of each page, and some one must submit copy for it. The printer might make one, the editor usually does, but the logical person to select it is the author himself.

The present publishers of PHYTOPATHOLOGY have their plant standardized to produce efficiently and on a definite schedule (scientific management). Composition of matter in different sizes of type is done on different machines. As a matter of economy in production, footnotes and any other matter to be set in different type from that of the body of the text is clipped out of the manuscript and pasted on separate sheets. Authors might save the journal the trouble and expense of this by inserting such matter on separate sheets and by numbering bibliographical citations consecutively and typing the references on separate sheets. In the same way authors would save the editor extra work by bearing in mind that legends for illustrations are almost invariably a part of the manuscript and should be submitted on numbered pages of it, not attached to the illustrations as is commonly done.

Illustrations as submitted are rarely in condition to go to the engraver. The important feature of a photograph often occupies only a few square inches in the center. If this part is indicated by pencil marks it is reproduced without reduction and a margin is left by which the engraver may handle the photograph even with soiled fingers. Heavy pencil marks on the back of a photograph usually cut through enough to alter the reflection of light from the surface, and for the same reason photographs mounted by gluing the corners only are equally objectionable. Usually unt immed and unmounted prints are preferred, but when a composition illustration is employed the prints should be pasted to a heavy card and dried under pressure in order to prevent wrinkling. At least one-third of the photographs submitted for publication in PHYTOPATHOLOGY in the last three years have had to be replaced by new ones owing to neglect in one or more of these respects or because they were broken in transit. A surprisingly large number of prints are broken in the mails. In this connection it is to be noted that shipment of manuscript by prepaid express usually is cheaper and almost always is more satisfactory than shipment by mail.

Alterations in proof are very expensive. In some cases they are necessary but when authors use the proof sheets as a place to put the finishing touches on their

article, as apparently has been done in a few instances, they should be allowed to pay for the alterations. It should be noted here that the publishers correct the typographical errors for which they are responsible, at their own expense.

DONALD REDDICK.

ILLUSTRATING BOTANICAL PAPERS[1]

Long editorial experience in various methods of illustration of the BOTANICAL GAZETTE has convinced me that much more adequate and satisfactory results might be secured if authors knew something of the modern methods for reproducing photographs and drawings, and particularly of the requisites for success. Requests for information of this kind, as well as the need felt in the editorual rooms, have determined me to discuss, as briefly as possible, the more important points.

The first question for author and editor to settle is this: Shall the figures be distributed in the text or aggregated into plates? Too often this is unconsidered or decided in conformity to a custom which arose out of necessity in the past. The process of engraving wood and metal by hand was the original and very costly method of illustrating books and monographs. (The journal and short paper were not then in existence.) The invention of lithography offered a vastly cheaper method, which was quickly adopted. The advantage of having figures close to the text they illustrated was surrendered, chiefly on account of the financial advantage, and partly because better effects could be secured by the new process. Modern methods, however, have made possible again the use of the text cut at the point where the figure will be of the most service to the reader. It is highly illogical, therefore, to conclude that because lithographed plates were used in the last century to illustrate the best scientific treatises and monographs, this mode of illustration is today evidence of first-class work. Yet novices are liable to precisely that misconception. There are some cases in which plates are still preferable to text cuts; e. g., when a large series of figures must be before the eye at once, or when the same figure must be referred to at many points. But these cases are much rarer than the prevalence of plates would indicate. Rather this prevalence indicates a want of consideration by the author, who from habit demands plates for a paper, but would never think of illustrating a book so. Having determined whether text cuts or plates are best, the mode of reproduction must be selected, for it is absolutely necessary to adapt the drawings to the chosen mode.

At present the following forms of illustrations appear in scientific journals: (1) lithographs; (2) photolithographs; (3) photogravures; (4) half-tones; (5) copper and zinc etchings; (6) wood-cuts. I propose to state the nature of each of these, its limitations, its adaptability to special needs, and the requisites, so far as the author is concerned, for successful reproduction of illustrations by each process. Some examples of each are cited from the recent volumes of the GAZETTE. This citation does not imply that the "copy" was what it should have been; but when it was not the citation is made in order to show what can be done even when the drawing was poorly adapted to a particular mode of reproduction.

1. **Lithographs.**—These are made by drawing with crayon or pen on a stone or metal plate the design to be printed. It requires an expert draftsman, accustomed

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[1] Botanical Gazette **43**: 59–63. 1907. Reproduced by request of the membership of the American Phytopathological Society and with the permission of *The Botanical Gazette*.

to botanical work, to make such drawings well. Even at best the draftsman may make mistakes, or introduce interpretations foreign to the author's design. The chances of error increase the poorer the original drawing and the more the lithographer has to alter it to make it presentable. Thus the only advantage of the intervention of an artistic hand is accompanied by a distinct disadvantage, and this disadvantage is increased by the likelihood that he who can only make a poor representation of his observations is the more likely to overlook errors on the part of the draftsman.

In this country the cost of lithography is almost prohibitive, and the work on histological and cytological subjects is rarely good. The inevitable delays, if drawings are sent to Germany and proofs returned, not to mention other difficulties, make it almost impracticable to attempt lithography. And if good drawings can be furnished, other methods are far better, because they provide for photographically exact reproduction. The only possible reason why a lithograph should be desired lies in the necessity of making poor drawings presentable. This should be obviated, if a second hand must intervene, by employing an artist to make drawings which can be reproduced photographically. Money is much more wisely spent on clear and accurate drawings, which can be corrected at leisure, than on expensive lithographs, with the artist across an ocean or a continent.

Examples:—**32:** pls. 1–3 (German work, cytological); **33:** pls. 10, 11 (American work, entire plants); **30:** pl. 12 (American work, cytological).

2. **Photolithographs.**—These are made by covering the surface of stone or metal with a composition which will become insoluble when exposed to light and printing on this prepared surface a photographic positive of the design. After further preparation the design may be printed on paper by inking the face of the plate. Such printing is done by special power- or hand-presses and cannot accompany the text, It is available therefore for plates only. It is not an expensive process and gives better results than zinc etchings. It is recommended whenever plates are required. The drawings must be of the same kind as for copper and zinc etchings (see **5**).

Examples:—**35:** pls. 4, 5; **36:** pls. 17–20 (printed in paler tinted inks); **37:** pls. 14, 15, 26, 27; **38:** pls. 1–4; and especially **42:** pls. 19–28.

3. **Photogravures.**—These are printed from an etched metal plate or from relief plates, the design being reproduced by rather elaborate mechanical and photographic means. The process is unsuited to anything but plates; and as the prints must be made separately on hand-presses, photogravure is expensive, costing three to four times as much as photolithographs, zinc or copper etchings, or half-tone work. The advantage is that photographs and all kinds of drawings (whether in ink, crayon, or pencil; whether in line or tint or wash) can be reproduced with the utmost fidelity, with an almost perfect rendering of tone and of light and shade. Pencil drawings, however, may be too weak in contrast to permit effective reproduction; and inasmuch as contrast is always somewhat reduced, shaded drawings should show a little more than is desired.

Examples:—**33:** pl. 1 (from pencil drawings); **34:** pl. 17 (from pen and wash); **37:** pls. 11–13 (from pencil and wash); **38:** pls. 6, 7 (from pencil, background removed).

4. **Half-tones.**—These are relief plates, usually of copper in which the "grain," instead of being of almost imperceptible dots irregularly distributed as in photogravure, is produced by a screen of ruled lines, whose intersections form equally spaced dots, isolated, or blended with others into irregular lines or surfaces. Half-tone work is adapted to photographs and to varied styles of drawing, like photo-

gravure; but as the "grain" is coarser it does not equal that process in delicacy or range. Yet when the screen used is fine and the workmanship first class, the results are almost as good. It has the very decided advantage that the metal plate may be mounted on a block and may then be printed along with type. It is necessary, however, to use a very smooth paper, either highly calendered or coated with clay. The coated papers are believed to be not durable and are to be avoided whenever possible.

Half-tone work alone is available for reproducing photographs to be printed in the text. Good prints (not negatives) are needed, showing sharply the details desired. Almost any sort of print can be reproduced; but engravers prefer, doubtless from habit, those made on Solio paper, toned brown. In case any painting-out of defects or background is to be done, unglazed prints are preferable.

If wash or pencil drawings are to be reproduced, contrast should be greater than desired, since there is necessarily a light gray background representing the whites of the picture. Except when figures have too intricate outlines this background can be cut away.

Examples:—**35:** 198–207; **38:** 48–57; **37:** 304–5 (which shows what can be done with simple apparatus by cutting away and vignetting the background); **39:** pl. 8 (pencil drawing, background cut away); **39:** pl. 4 (2d issue; from water color); **41:** pls. 1, 2 (from photomicrographs; compare with photogravure from similar originals, **32:** pls. 15–17); **41:** pls. 3, 4 (from pen and pencil, line and stipple, combined with wash; compare with photogravure from similar original, **37:** pls. 11–13).

5. **Copper and zinc etchings.**—All the previous processes are truly dependent on etching by some solvent as are these. The term is used to distinguish the copper or zinc plates, made without grain or screen, mounted type high and intended for printing on an ordinary press. Copper is used for the finer and more delicate work; zinc where the work is bold. Naturally the copper block is the more expensive. This process is in all ways the one best suited to reproduce drawings for text use. It is also satisfactory for plates; indeed there is scarcely any work that cannot be adequately and conveniently illustrated by it, if only the drawings are made with reference to this mode of reproduction.

Drawings must be in dead black ink (BOURGEOIS AINÉ, Encre de Chine Liquide; WINSOR and NEWTON, Liquid India Ink; HIGGINS, Waterproof Drawing Ink), and always in line and stipple only. Pale ink or a wash or tint make the use of the process impossible, unless the etching it supplemented by a second block in half-tone. Drawings should not be less than one half larger than the reproduction is to appear; preferably they should be of double size, and for open diagrams or charts treble or even quadruple size may be better. This permits refinement of line and fine shading without excessive care in making the original. To see how a coarse drawing will look a concave lens 4 or 5 cm. in diameter should be available. There are few observers who can draw at all, and none who draw well with a pencil, who cannot readily acquire the art of drawing with ink in a style suitable to be reproduced by copper or zinc etching. This gives freedom to put illustrations in the text where this is desirable or to combine them into a plate if necessary.

Examples:—**26:** pls. 1, 2 (a fine example of pure line); **32:** pls. 10–12 (almost pure stipple); **33:** pl. 14 (line and stipple); **36:** facing p. 188 (map, letters and figures pasted on; red index lines and figures by second printing); **39:** facing p. 102 (map two blocks made from single drawing and printed separately); **38:** 347–361 (graphs and intricate tabular work; note especially insert after p. 356); **40:** pls. 10, 11 (line with wash; block a combination of half-tone and zinc; not recommended).

6. **Wood-cuts.**—The expense of this process is prohibitive, especially in view of the many mechanical processes whose results are equal or better.

General suggestions.—It is advisable for convenience in sending drawings and photographs by mail that they be unmounted. If they are to be arranged in groups that cannot be designated by serial numbers alone, they may be arranged as desired on a sheet of thin paper, the outline of each roughly traced thereon, and the chart folded and forwarded with the separate sketches or photos in a small package.

Index letters should be printed and pasted on at the end of index lines. Avoid the use of more than one letter at each line, but keep the same letter for the same structure throughout. *Syn* is no more significant, as applied to synergids, for anyone competent to read the paper, than the letter *s* or *x*. Sheets of printed letters and numbers will be supplied on request.

It is very instructive to compare original drawings and reproductions; much can be learned from a single experience which can be applied to modifying future work.

For drawing, an ordinary sharp Spencerian or Gillott pen is better than the excessively fine lithographic and crow-quill pens. Fine lines and very fine dots are not only entirely unnecessary, but too often they disappear in etching the plate, when moderately coarse lines and dots are properly reduced. Bold drawing on a large scale with proper reduction gives better results than the fine work done under a lens on a scale that permits only one-fourth reduction or less. Plates may be printed in paler inks or tints to secure softness. Drawings unsuited to photographic reproduction are often excused on the ground that the author drew indistinctly because he saw the outline faintly. But a drawing which is dead black and shows the harshest contrast in order to be reproduced photographically, may be printed in as faint a tint as desired, thus reducing contrasts and eliminating the objectionable harshness. Where extreme gradations of tone are necessary, of course half-tone or photogravure should be employed.—CHARLES REID BARNES, *The University of Chicago.*

Photo- elatin process.[2] The photo-gelatin process (the term used by the public printer to designate the various methods of collotype printing, which includes the trade names heliotype, albertype, phototype, lichtdruck, photoglytie, etc.) is especially adapted to the reproduction of material where the grating used in the half-tone method would result in loss of minute detail or would introduce artefacts. Examples: Phytopath. **3**: plates 8, 10, 11, 12, and 13. 1913 and **4**: plates 1, 2, and 8, 1914.

The full range of values between black and white can be reproduced by this method. The original copy may be photographs, wash drawings, pencil work, or a combination of any or all of them. It is unnecessary to have the original larger than the required reproduction, although this may be advisable in the case of drawings where the detail is too fine to draw in in the actual size. Some engravers can secure the best results if original *negatives*, the same size as the required reproductions, can be furnished. Such negatives must be properly timed, well developed and fully fixed.

The cost of reproduction by the photo-gelatin process varies. When a sheet of eight or sixteen plates can be printed at once the expense may not be greater than for good half-tone work but the reproduction of a single plate usually is considerably more expensive. It is possible to print on both sides of the paper which in

[2] Supplementary notes by D. Reddick.

some cases is a material advantage, but there is no practical saving in expense because of the extra spoilage.

Color work.[3] With the development of color photography the use of colored illustrations is possible for all pathologists whether they are artists or not. The use of colored illustrations is particularly valuable in plant pathology and the only important reason for not using them oftener is the expense. Either three or four (a technical matter for the engraver to decide) exposures are made through filters and as many engravings prepared. Special skill is required in finishing the engravings as well as in printing from them. The expense is consequently considerably more than three or four times that of work in one color.

Original specimens are preferred by most engravers but paintings can be reproduced faithfully.

APPENDIX

ATLANTA CONFERENCE

MINUTES OF THE WAR EMERGENCY CONFERENCE OF SOUTHERN PATHOLOGISTS

In response to a call from Prof. H. W. Barre, Commissioner for the South of the War Emergency Board of the American Plant Pathologists, a number of Pathologists interested in Southern problems and their needs, met in Atlanta, Ga., January 30 and 31 to discuss plans for increasing the effectiveness of pathological work in the South during the coming season, with particular reference to increased food production and food conservation. Professor Barre, Director of the South Carolina Agricultural Experiment Station, presided and Dr. G. L. Peltier, Pathologist, Alabama Agricultural Experiment Station, was elected secretary. The states of North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi and Tennessee, and the Plant Disease Survey, Office of Cotton and Truck Disease Investigations and the Office of Cereal Investigations of the United States Department of Agriculture, were represented by one or more men.

Dr. G. R. Lyman, Pathologist, Plant Disease Survey, and Commissioner at Large of the War Emergency Board, and Mr. W. W. Gilbert, Pathologist, Office of Cotton and Truck Disease Investigations, spoke of the discussion at the Pittsburgh meeting of the American Phytopathological Society which resulted in the appointment of the War Emergency Board. They outlined the aims and plans of the Board, and emphasized the need for coöperation and correlation of work on the part of all pathologists in order that the greatest possible efficiency may be reached this year. The general discussion which followed emphasized the similarity of the problems and conditions in the Southern States. The specialists present decided to pool their interests and resources as far as possible and to so coördinate their efforts in the various lines of work as to secure uniformity of method and maximum efficiency in each state. Accordingly each problem to receive special attention this season was assigned to some pathologist who was requested to act as leader in that field with the coöperation and assistance of all other pathologists.

The various phases of extension work were taken up first. It was decided to limit the principal drive of the summer's campaign to those plant diseases which are well

[3] In this connection see Reddick, Donald. Reproduction of autochrome plates. Phytopath. **6**: 306. 1916.

understood and for which effective control measures have been thoroughly worked out. The field was divided into major and minor problems, those considered to be of major importance being:

Cotton diseases. Extension work on cotton anthracnose will be pushed in North Carolina, South Carolina, Georgia and Texas, according to a plan submitted by Professor Barre which he is using with much success in South Carolina, while cotton wilt will be taken up in each state included in the southern section where the disease is severe. The cotton work will be under the leadership of Mr. L. O. Watson, Pathological Advisor for the South, Office of Cotton and Truck Disease Investigations, assisted by the state and extension pathologists.

2. *Root knot.* A campaign for the control of root knot of cotton and other farm crops will be undertaken under the direction of Mr. L. O. Watson in connection with the cotton wilt work with which it is closely associated.

3. *Sweet potato diseases.* Due to the very large losses of sweet potatoes in storage this season, it was determined to make a thorough campaign for the control of the diseases of sweet potatoes, both in field and in storage. Dr. L. L. Harter, Pathologist, Office of Cotton and Truck Disease Investigations, was asked to direct this work, to be assisted so far as possible by all the pathologists of the Southern states.

4. Seed testing of corn for molds is to be pushed before planting time under the leadership of Dr. H. B. Humphrey, Pathologist, Office of Cereal Investigations.

5. *Cereal smuts.* Seed treatment work was placed under the charge of Dr. H. B. Humphrey.

It was the consensus of opinion that only these five extension problems should be especially stressed at this time. A number of diseases of secondary importance were considered and as far as possible some work is to be carried out on them. Some of the problems considered and the men who are to direct the work are as follows:

a. *Tomato wilt,* by Mr. F. J. Pritchard, Office of Cotton and Truck Disease Investigations, Dr. C. W. Edgerton, Plant Pathologist, Louisiana Agricultural Experiment Station, and Prof. S. H. Essary, Assistant Botanist, Tennessee Agricultural Experiment Station.

b. *Other tomato and vegetable diseases,* by Dr. C. D. Sherbakoff, Associate Pathologist, Florida Agricultural Experiment Station, and Dr. J. Rosenbaum, Pathologist, Office of Cotton and Truck Disease Investigations.

c. *Watermelon diseases.* A series of demonstrations for the control of anthracnose and stem end rot are to be carried out under the direction of Mr. F. C. Meier, Office of Cotton and Truck Disease Investigations.

Emergency research was then considered and it was agreed that each Station shall devote some time to one or more of the problems mentioned below, and that the state and extension pathologists shall assist in every possible way in pushing this work through as rapidly as possible. Prof. R. C. Faulwetter, Associate Pathologist, South Carolina Agricultural Experiment Station, was assigned the leadership in the study of boll rots, matting, and angular leaf spot of cotton. The diseases of velvet beans, particularly the study of the organisms involved in the spoilage of velvet bean meal, was assigned to Dr. George L. Peltier, Pathologist, Alabama Agricultural Experiment Station. Drs. F. J. Pritchard, C. W. Edgerton, C. D. Sherbakoff, and J. Rosenbaum were urged to continue their studies on tomato and other vegetable diseases. The Office of Cereal Investigations was asked to devote more time to a study of the leaf rusts of cereals, and to begin an investigation of the

root and ear rots of corn. Those present also agreed to give Dr. W. H. Tisdale, Scientific Assistant, Office of Cereal Investigations, all possible assistance in his study of the Physoderma disease of corn. Considerable discussion of the loss caused by *Sclerotium rolfsii* took place but in view of the difficulties involved and the time necessary to complete a study of this fungus, it was deemed best to postpone this problem until a more opportune time, although it is of extreme importance in the South.

As emergency problems, whether extension or research, are met with during the coming season, they will be assigned by Commissioner Barre, of the War Emergency Board, to some pathologist who will assume leadership and with the coöperation and assistance of all the state and extension pathologists will push forward the work as rapidly as possible. Commissioner Barre expressed the hope that the southern pathologists not present would send in any suggestions which will improve the program as outlined. This program is aimed to secure concentration and efficiency, and must be modified from time to time according to conditions.

A discussion of the available man power followed. The colleges in the South were canvassed and only a few men were found with sufficient training to take up extension and field work. The scarcity of young men was indeed surprising. A number of factors appeared responsible for this condition. At the present time only one or two colleges in the South offer any graduate work in plant pathology, while in most of the others only a short course is offered, and this is usually given by some one other than the plant pathologist. It was deemed imperative that some attempt be made to revise the curricula at some of the southern institutions so that promising men who are now lost could be developed into plant pathologists. In practically all the southern colleges, the assistants and most promising students have already enlisted in some branch of the army.

To partially overcome this shortage of trained men for pathological work in the South, several suggestions were offered. It was urged that whenever possible, research on the less important crops be dropped or reduced to a minimum for the present and more time devoted to extension and emergency research. In many cases, instructors and professors may be relieved of a portion of their teaching so that they can devote more time to emergency work. It was suggested that women might be used in the laboratory for routine work, allowing the pathologist more time for extension work.

Another topic which created considerable discussion was the question of the form of publication most likely to benefit the farmer. It was finally decided that the pathologists in the South will pool all circulars, press bulletins, and form letters used in replying to inquiries relative to diseases of southern crops, and forward copies to Mr. L. O. Watson, Florence, S. C. He will have them revised by experts, and copies sent to all southern pathologists. Where no circulars, form letters, etc., now exist specialists will be asked to write them, so that they may be available for use by all the men engaged in pathological work. By the use of form letters in answering letters of inquiry, a considerable saving in time will be effected. By the use of these short, concise publications, it was felt that the pathologist can reach the farmer much more effectively than by sending him lengthy bulletins, and at the same time, uniformity in the subject matter sent out will result.

At the close of the meeting those present felt that the Conference had been of such value that steps were taken to perfect a formal organization of all the pathologists of the Southern states. Accordingly the following officers were elected for 1918: President, Prof. H. W. Barre of South Carolina; Vice President, Dr. C. W.

Edgerton of Louisiana; Secretary-Treasurer, Dr. H. E. Stevens of Florida. The officers were empowered to act as a committee to take up the question of affiliation with the American Phytopathological Society as a southern section. They were also authorized to set a date and arrange a program for the next meeting and to handle any emergency matters which may arise during the coming year.

(Signed) GEORGE L. PELTIER,
Secretary.

WASHINGTON CONFERENCE

MINUTES OF THE WAR EMERGENCY BOARD OF AMERICAN PLANT PATHOLOGISTS

A special meeting of the War Emergency Board was held in Washington, D. C., February 9, 10, and 11, 1918. The following Commissioners were present: Prof. H. H. Whetzel, Chairman, of Cornell University, Dr. F. D. Kern of The Pennsylvania State College, Dr. E. C. Stakman of the University of Minnesota, Prof. H. P. Barss of Oregon State Agricultural College, Prof. H. W. Barre of Clemson College, S. C., and Dr. G. R. Lyman of the Bureau of Plant Industry.

Dr. Mel. T. Cook of the New Jersey Agricultural Experiment Station and Prof. H. S. Fawcett of the Citrus Experiment Station, Riverside, Calif., also took part in the deliberations of the Board, and many of the federal pathologists were called in consultation. Open meetings were also held at which practically all the pathological workers of the Department of Agriculture were present, for discussion of the program of war emergency work.

All the Commissioners reported practically universal approval of the aims and objects of the War Emergency Board on the part of the pathologists and administrative officials directing the agricultural work of their respective districts. Hence the Board is assured of active and enthusiastic support on all sides. The Board will find its most important work in capitalizing and translating into action the spirit of coöperation which has been stimulated and developed by the national emergency caused by the war.

The Board noted with approval the definite program of coöperation both in extension and research work adopted by the pathologists of the Southern Section in the conference held at Atlanta, Ga., January 30 and 31, which must greatly increase the efficiency of the pathological work undertaken in that section this season. It was decided that similar conferences should be called during February and March by the Commissioners of the other five sections of the country, thus giving the pathological workers of each district an opportunity to discuss their common problems and decide upon definite plans for coöperative action.

Commissioner Kern reported on the progress of the census of pathologists being carried on under his direction. Enrollment questionnaires were sent out to pathologists and botanists some time ago, and all were urged to send in the names of others to whom the enrollment cards should be sent, in order that we might have as complete a census as possible of all persons able to carry on pathological work during the coming season. The response has been hearty and replies are still coming in. While it is not yet possible to make a definite statement as to the total number of available pathologists, it is already apparent that there will be a serious shortage of workers to carry out the important emergency work already planned by state and federal agencies. Every effort will be made to utilize all available men in the positions where they will be of greatest service, and lists of workers are being prepared for distribution, classifying those who have registered according to

geographical location, special qualifications, length of time available for work, and in other ways.

Extension work for this season, in charge of Commissioner Whetzel, was considered at some length. The activities of the War Emergency Board in this direction must consist largely in efforts to stimulate a more concentrated and correlated attack upon certain important diseases through the established state and federal channels. It was agreed that the decision as to what extension campaigns should be pushed must be decided by the conferences of pathologists of the various sections. These are in most cases regional problems and cannot be wisely decided by the Board for the country as a whole.

The teaching of pathology during war times was discussed by Commissioner Whetzel. In view of the great and increasing shortage of pathological workers, all teachers of pathology should endeavor to give their promising students special training. Particular emphasis should be laid on pathological courses in many educational institutions, and such courses should be introduced where they do not now exist. An increased supply of young pathological workers should thus be assured one year from now. Moreover, during the present semester special war emergency short courses open to all students without prerequisite should be instituted to give elementary training in plant pathology with a view to preparing the students for more effective work on the farms this coming season.

Commissioner Stakman outlined his work to date on the correlation of emergency research. Responses to his questionnaire on research problems were quite general and reasonably prompt. While it was the general opinion that much pathological research cannot be called strictly war emergency work on account of the uncertainty as to time of obtaining results, yet there are many research problems of a distinctly emergency nature which can and should be pushed. The great work of the Board in this field will be to coördinate research work and to secure voluntary coöperation in the solution of pressing problems by working through the established state and federal agencies. Such coöperative research on a broad scale has already been begun on the subject of seed treatment for cereal smuts and will be pushed to an early conclusion in order that present uncertainties as to the best methods of treatment for different varieties and regions may be cleared up. There are other problems calling for nation-wide coöperative attack but in general research problems are regional and can best be organized in the sectional conferences of pathologists where the different problems are acute. Commissioner Stakman will, from time to time, issue notices of coöperative research projects which are being taken up, giving the names of the leaders and an outline of the work. The War Board felt that this work of promoting coöperative research is one of the most important it can undertake, and that it has very far-reaching possibilities affecting American plant pathology.

Commissioner Lyman, in charge of crop loss estimates, reported on the collecting of data. Very gratifying response to his request for information on this difficult subject was received from pathologists throughout the country. A questionnaire sent to the county agents also yielded valuable data on certain important diseases. As a result a large body of data, probably more extensive than has ever before been collected, is now being classified and arranged. These figures will be resubmitted to the state and federal pathologists for thorough revision with a view to making them as authoritative as possible. They will then be issued in a special number of the *Plant Disease Bulletin* for general distribution. The Board agreed that these crop loss estimates should be utilized as fully as possible in educational and pub-

licity campaigns. The Board also requested the Plant Disease Survey to collect such data as may be available from all sources on losses due to transportation and storage rots.

Commissioner Kern reported on plans for the conduct of a publicity campaign. It was agreed that it is very important that the general public be more thoroughly informed as to the significance of phytopathological work, including the losses due to diseases and storage rots, the significance to the public of these losses and their connection with high prices and food shortage. All possible agencies should be employed by pathologists generally to get this information to the public which is now interested in the subject on account of war conditions. Pathologists should publish articles in newspapers and popular magazines and should embrace every opportunity to deliver popular lectures on pathological subjects before miscellaneous organizations. Exhibits, displays and motion pictures should also be utilized.

The War Emergency Board adopted the following resolutions and it is hoped that all pathologists will assist in carrying them out and in translating them into action.

WHEREAS, The situation this year as regards extension work on the control of plant diseases presents many unusual and critical features inasmuch as never before has there been such urgent need for control work in order that the food supply may be increased, while at the same time the general application of control measures will be rendered very difficult on account of the serious shortage of farm labor, making it almost impossible for the farmer to undertake any work not absolutely essential; whereas on this account great care should be taken that the control work advocated is such as to bring tangible results, in order that the whole subject of plant disease control may not fall into disrepute among the growers,

Therefore, be it resolved that principal emphasis this year should be placed on the serious diseases of the more important food crops for which control measures are thoroughly proven, and relatively easy and cheap of application; and

Resolved that all extension workers should be carefully instructed before going into the field as to the nature and scope of the work to be undertaken and the ways and means to be employed.

WHEREAS approximately 130,000,000 bushels of wheat and other cereals are lost annually on account of the attacks of preventable smuts, and, since this loss can be prevented easily at a cost not exceeding 3 cents per acre for materials and labor,

Therefore, be it resolved that the War Emergency Board urge the enactment of legislation or the adoption of other methods for securing compulsory treatment of seed wheat, oats, barley and rye to eradicate preventable smuts and other diseases.

WHEREAS, Extensive observations have shown that the common barberry (*Berberis vulgaris*) including its horticultural varieties, is an important link in the life history of stem rust of cereals in the upper Mississippi Valley, enabling it to develop and spread early in the season, thus conducing to serious epiphitotics; and whereas, the value of the common barberry in that region is insignificant compared with the value of cereal crops, especially since the immune Japanese variety (*Berberis thunbergii*) is displacing the common variety in popular favor,—

Therefore, be it resolved, that the War Emergency Board of American Plant Pathologists do hereby endorse and support the efforts to eradicate the common barberry in that region.

G. R. LYMAN, *Secretary*.

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